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SUICIDE AND ITS RELATION TO CLIMATIC AND OTHER FACTORS

BY

JOHN RICE MINER, PH.D.

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By JOHN RICE MINER, Sc.D.

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SUICIDE AND ITS RELATION TO CLIMATIC AND OTHER FACTORS.

Suicide is a subject which has engaged the attention of divers fashions of men. The moralist, the sociologist, the psychiatrist, the vital statistician have all written extensively on it. That the subject has its biological implications has not been so generally recognized, yet the death rate from suicide is distinctly a selective death rate, the selection acting upon a higher plane than with other causes of death. The person dying from influenza or other disease dies because his body is unable to make a satisfactory physiological adjustment to its environment; the person who commits suicide dies because his mind is unable to make a satisfactory psychic or social adjustment to its environment. Changes in the frequency of suicide may thus depend on changes either in the environment or in the individual.

It is a little strange that, although suicide has frequently engaged the attention of statisticians, it has not, so far as I know, been treated by the newer statistical methods. This may be due to the fact that the subject has not received so much attention of late years as in the pioneer period of social statistics. The present study consists of three parts, first, a survey of various statistical aspects of suicide, second, a study, by the methods of partial correlation, of the relation of suicide to certain climatic and other factors, and third, a partial bibliography of suicide, especially in its statistical aspects.

The author wishes to acknowledge his indebtedness to Dr. Raymond Pearl for advice in the planning of the study and encouragement in its execution.

I. Statistical Survey.

1. *Trend of suicide rates.*

When Morselli wrote his well-known work on Suicide he concluded that "in the aggregate of the civilized states of Europe and America, the frequency of suicide shows a growing and uniform increase" (p. 29). Let us see what effect the half century since he wrote has had on his conclusion. In Table I, showing the suicide rates of various countries by five-year intervals up to 1911 and from then by single years, the rates prior to 1871 are from Morselli's Table III (p. 22), except for the English rates, which are calculated from material in the reports of the Registrar-General. From 1871 the rates are quoted

TABLE I.

Suicides per 100,000 inhabitants for various countries.

Country.	1816–1820.	1821–1825.	1826–1830.	1831–1835.	1836–1840.	1841–1845.	1846–1850.	1851–1855.	1856–1860.	1861–1865.	1866–1870.	1871–1875.	1876–1880.	1881–1885.	1886–1890.	1891–1895.	1896–1900.	1901–1905.	1906–1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Spain																												
Bosnia and Herzegovina																		2.2	2.8	4.5	4.6	5.5	5.9	6.1				
Ireland				1.0											0.6	1.9	3.7	4.0										
Portugal										(1.4)	1.5	1.8	1.8	2.2	2.4	2.9	2.9	3.3	3.4	3.4	3.8	3.5	2.7					
Italy																		(4.7)	(5.1)									
Scotland										(2.8)	3.0	3.5	4.1	4.9	5.0	5.7	6.3	6.3	7.9	7.9	8.5	8.8	8.9	8.1				
Finland												3.3	4.7	5.3	5.8	6.0	6.0	6.0	5.6	5.3	5.9	5.9	5.5	5.0	4.6			
Serbia												2.9	3.3	3.9	4.0	4.8	4.7	5.5	7.6	8.7	9.3	11.8	10.2	8.3	6.9			
Netherlands														3.8	3.7	3.6	4.0	5.1	5.8	6.5								
Norway		8.0		9.7	10.9	10.7	11.0	10.7	9.4	8.5	7.6	7.5	7.2	6.7	6.7	6.5	5.5	6.4	6.7	6.2	6.0	6.8	6.0	6.2	5.8			
Roumania															4.2	5.5	7.0	6.4	4.9	5.6	6.6	6.4	5.1	5.9	4.6			
Uruguay																												
England and Wales					(6.2)			(5.7)	(6.5)	6.6	6.7	6.6	7.4	7.5	7.9	8.9	8.9	8.5	8.8									
Australia												10.1	10.6	9.7	11.6	11.9	12.4	10.3	10.2	9.9	9.9	9.6	10.1	7.8	7.3	6.4	7.4	9.1
Belgium				3.9	4.6	6.2	6.0	(3.7)	5.5		6.6	7.0	9.4	10.7	11.9	12.9	11.9	12.5	11.6	12.1	13.6	13.5	13.1	13.3	11.8	10.2	10.0	
Bavaria						5.5	7.3		8.0		9.0	9.1						12.4	12.7	13.7	13.5							
																		14.1	15.0	16.2	15.9	17.6	16.2					

TABLE I (*Continued*).

Country.	1816–1820.	1821–1825.	1826–1830.	1831–1835.	1836–1840.	1841–1845.	1846–1850.	1851–1855.	1856–1860.	1861–1865.	1866–1870.	1871–1875.	1876–1880.	1881–1885.	1886–1890.	1891–1895.	1896–1900.	1901–1905.	1906–1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Sweden	4.8	5.8	...	6.9	6.6	6.6	6.7	7.1	5.7	7.6	8.5	8.1	9.2	9.7	11.8	14.4	11.9[1]	12.4	16.1	17.6	18.3	17.9	15.9	....	....	....	....	....
Massachusetts	....	....	....	....	....	....	....	6.9	8.0	6.3	6.1	8.0	8.1	9.1	7.9	9.5	9.9	10.3	12.2	13.0	13.3	13.4	13.4	14.0	12.3	13.3	13.0	11.6
United States (Registration Area)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	13.9	16.0	16.2	16.0	15.8	16.6	16.7	14.2	13.4	12.2	11.4
Austria	....	....	....	....	....	....	....	....	....	....	....	10.6	16.2	16.2	16.0	15.9	15.8	17.3	18.2	19.7	20.2	21.1	....	....	....	....	....	....
Hungary, kingdom	....	....	....	....	....	....	....	....	....	....	....	....	....	8.4	(10.2)	(12.3)	16.3	17.6	18.5	19.1	19.5	19.9	19.0	16.1	....	....	....	....
Hungary proper	....	....	....	....	....	....	....	....	....	....	....	....	(7.6)	8.9	(10.8)	(13.2)	17.7	19.1	(19.2)	....	....	....	....	....	....	....	....	....
Japan	....	....	....	....	....	....	....	....	....	....	....	....	(11.0)	14.6	15.9	17.9	18.5	20.1	17.3	18.2	18.2	19.6	20.3	18.6	17.4	....	....	....
Prussia	7.4	8.3	8.9	9.6	10.3	11.0	9.9	13.0	12.3	12.2	14.2	13.4	.....	20.2	20.0	20.5	19.5	20.3	20.5	20.8	21.3	22.2	20.8	....	....	....	....	....
German Empire	....	....	....	....	....	....	....	....	....	....	....	....	.....	21.1	20.5	21.1	20.2	21.2	21.4	21.7	22.5	23.2	21.8	....	....	....	....	....
Denmark	....	....	....	....	21.3	23.2	25.8	27.2	27.6	28.8	27.7	24.3	26.7	24.8	26.1	25.0	22.1	22.7	19.2	18.9	18.2	18.0	18.3	17.6	15.8	13.8	12.8	....
France	....	....	5.4	6.4	7.6	8.5	9.7	10.0	11.0	12.4	13.5	14.4	16.8	19.4	21.6	24.1	23.2	22.8	21.7	22.1	23.2	23.0	....	....	....	....	....	....
Switzerland	....	....	....	....	....	....	....	....	....	....	....	....	22.7	23.3	22.1	22.2	22.2	23.2	22.3	23.6	23.3	24.7	24.3	21.5	20.1	....	....	....
Saxony	....	....	....	....	15.8	19.8	19.9	24.8	24.5	26.4	29.7	26.8	38.3	37.9	32.3	32.1	30.5	32.5	32.6	31.5	32.3	34.1	32.0	....	....	....	....	....

[1] This sudden decrease is due to the fact that cases of death by poisons self-administered for purposes of abortion have been excluded.

from Knibbs (1912) with additions from the official publications of the various countries. Parentheses indicate that the rate is based on fewer than five years' experience.

The data of Table I are shown on a logarithmic scale in Figs. 1–8.

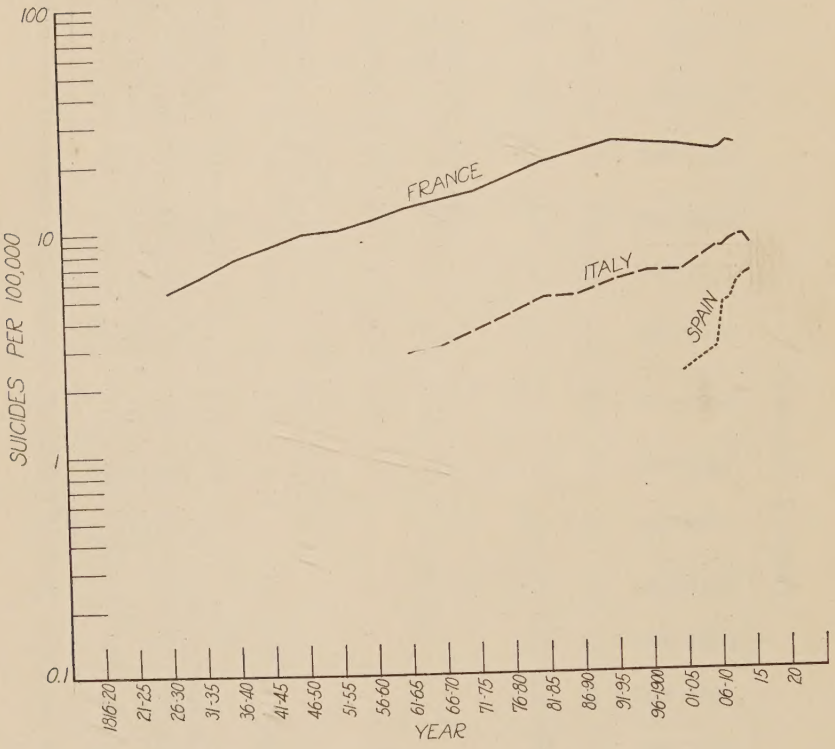

FIG. 1. Suicides per 100,000 in France, Italy, and Spain.

Before discussing the trend of these rates it will be well to see whether or not they may be chance fluctuations from a constant probability of suicide. This may be done in the following manner. If the changes in the suicide rate of an area over a series of years are mere chance fluctuations from a constant probability of suicide, their standard deviation will be given by

$$\sigma' = \sqrt{\frac{p_0(1-p_0)}{s}},$$

where p_0 is the mean probability of suicide during the period and s the

mean population. With this value, which does not depend on the rates for the individual years but simply on the mean rate for the period, may be compared the standard deviation derived from the actual series by the formula

$$\sigma'' = \sqrt{\frac{\Sigma(p_i - p_0)}{z - 1}},$$

where p_i denotes the rates for the individual years, and z = the number of years. If $Q = \frac{\sigma''}{\sigma'}$ is unity, the changes in the death rate are merely

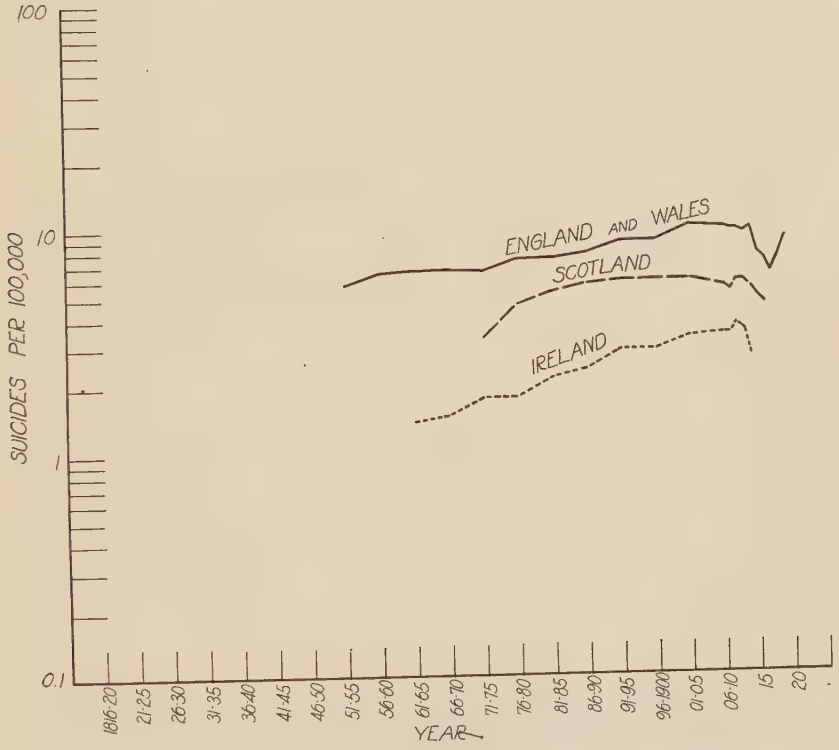

FIG. 2. Suicides per 100,000 in England, Scotland, and Ireland.

of the magnitude which one would expect as a result of random variation; if however $Q > 1$, we may infer a true change in the probability of suicide during the period. The results of this test for the states of the United States Registration Area for 1900–1917 are given below:

	Q.		Q.		Q.
California	2.92	Michigan	3.65	Pennsylvania	2.13
Colorado	2.26	Minnesota	2.09	Rhode Island	1.20
Connecticut	3.57	Missouri	2.31	Utah	1.69
Indiana	5.37	Montana	1.28	Vermont	1.69
Kentucky	1.80	New Hampshire	1.77	Washington	3.21
Maine	1.48	New Jersey	2.75	Wisconsin	0.79
Maryland	1.98	New York	5.50		
Massachusetts	2.72	Ohio	1.26		

These values of Q are for the most part well above unity. We may therefore infer a true change in the suicide rates in the United States, and, since most of the countries in Table I show as noteworthy variations, we may extend our conclusion to suicide rates in general.

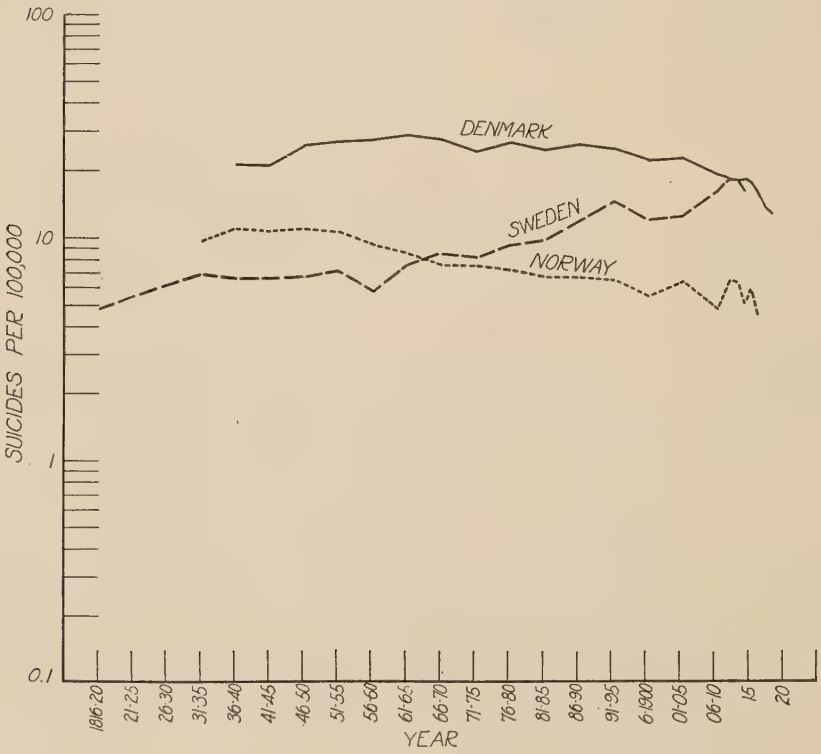

FIG. 3. Suicides per 100,000 in Denmark, Norway, and Sweden.

The general trend of the rates, during the last half century as well as before then, is upward. Yet there is an evident tendency for the

higher rates especially to become stabilized. In short, Morselli's suggestion that "perhaps the suicidal tendency having arrived at a certain stage of its progress pauses there (p. 23)" is borne out by the subsequent course of the death rates. Scotland, the Netherlands, England, Australia, Belgium, the United States, Japan, Prussia, France, Switzerland, and Saxony are all examples of the tendency to stabilization of the suicide rate. The rate of Saxony, which in 1876–1880 reached 38.3 per 100,000, the highest figure in the table, has since 1886 been stabilized around 32 per 100,000. The French rate, which increased with great regularity from 1826 to 1895, has since then declined on the whole.

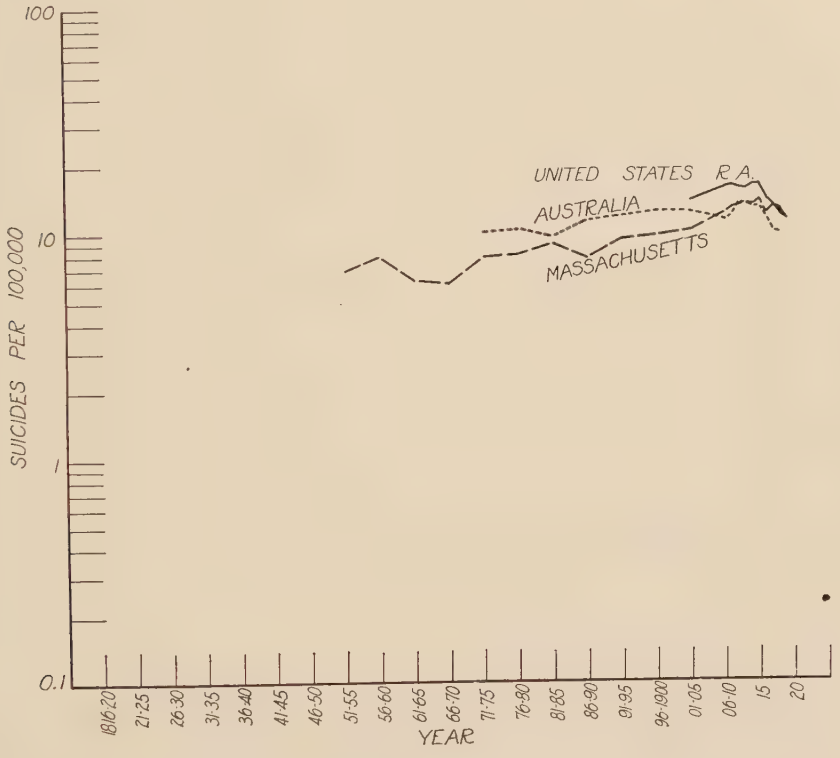

FIG. 4. Suicides per 100,000 in United States Registration Area, Massachusetts, and Australia.

It is natural to connect this increase in the suicide rate during the nineteenth century with the far-reaching changes in economic organization, the growth of the factory system and general increase in

the complexity of society which took place in the same period. According to this view the strain of factory life, the increased worry and risk attending the enlarging of the scale of commercial enterprise, the greater difficulty in general of adapting oneself to a more complex environment would take their toll from those who would have been able to adjust themselves satisfactorily to the earlier and simpler

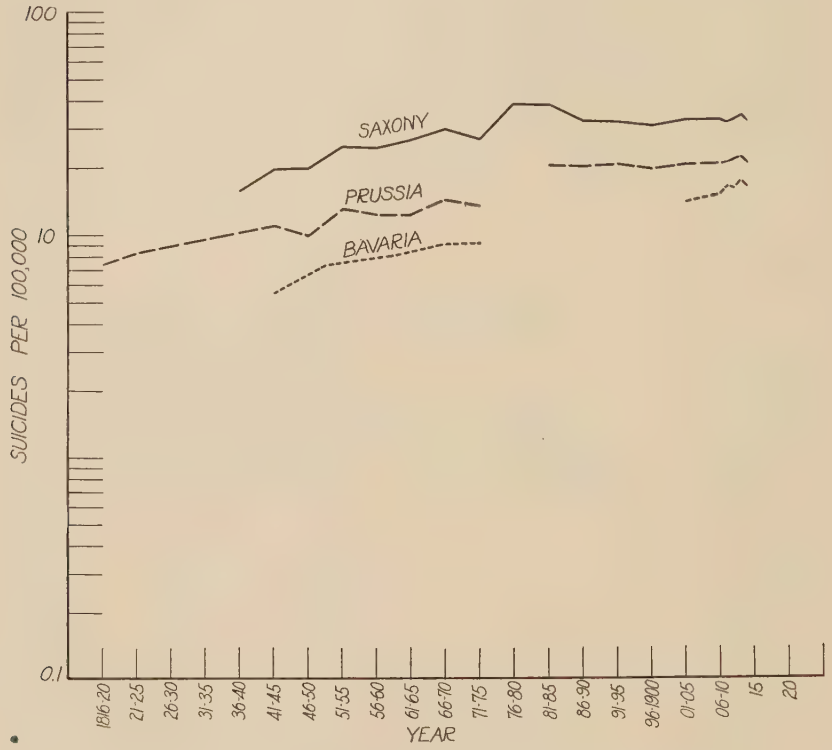

Fig. 5. Suicides per 100,000 in Prussia, Saxony, and Bavaria.

social order. During the period of transition from the old to the new the suicide rate would therefore increase, becoming stabilized on a higher level when the transition had been completed. The suicide rates of those countries in which the industrial revolution had begun earliest would show this tendency to stabilization at a period when the rates of countries which were still in the stage of transition were increasing. This resembles in general the picture that we have seen presented by the actual course of the rates. Yet if we examine the

countries in detail, we shall see that the facts do not bear out the hypothesis. Thus in Prussia and Saxony the period of increase in the suicide rate was from the time early in the nineteenth century, when the figures are first available, to about 1875 or 1880. Since that time the Prussian and Saxon suicide rates have been stabilized. Yet the industrial revolution had little effect on Germany until after the Franco-Prussian war, while it is in precisely the period of most rapid transition from an agricultural to an industrial type of organization, a transition perhaps unequalled in the suddenness with which it took place, that the suicide rates cease their former increase. Nor in the

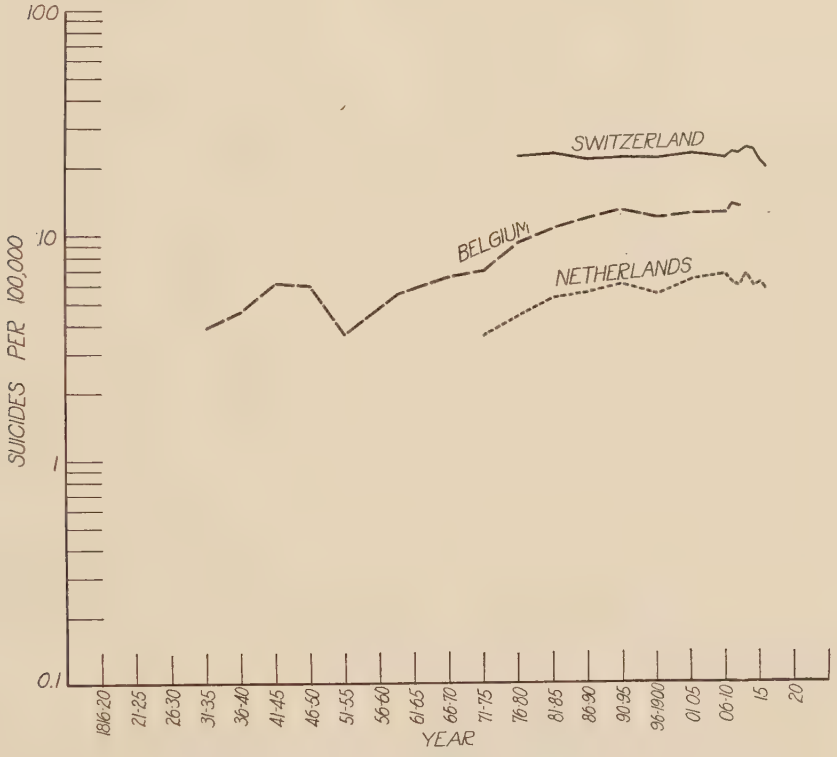

FIG. 6. Suicides per 100,000 in Netherlands, Belgium, and Switzerland.

other countries which show a stabilization of the suicide rate since 1890 or 1900 has there been a corresponding stabilization of industrial development. The transition period is in some respects ended, but the industrial organization has continued to become more complex, the pace of life has grown ever faster. We shall, moreover, see in the

section on the relation of suicide to occupation that those engaged in manufacturing do not in general show high rates, and in the second part of the paper that the correlation between the degree of industrialization of a city and its suicide rate is low and negative in sign, i.e., the larger the proportion of the inhabitants engaged in manufacturing the smaller the suicide rate. The hypothesis that the industrial revolution is the cause of the increase in the suicide rate is therefore not borne out by the facts.

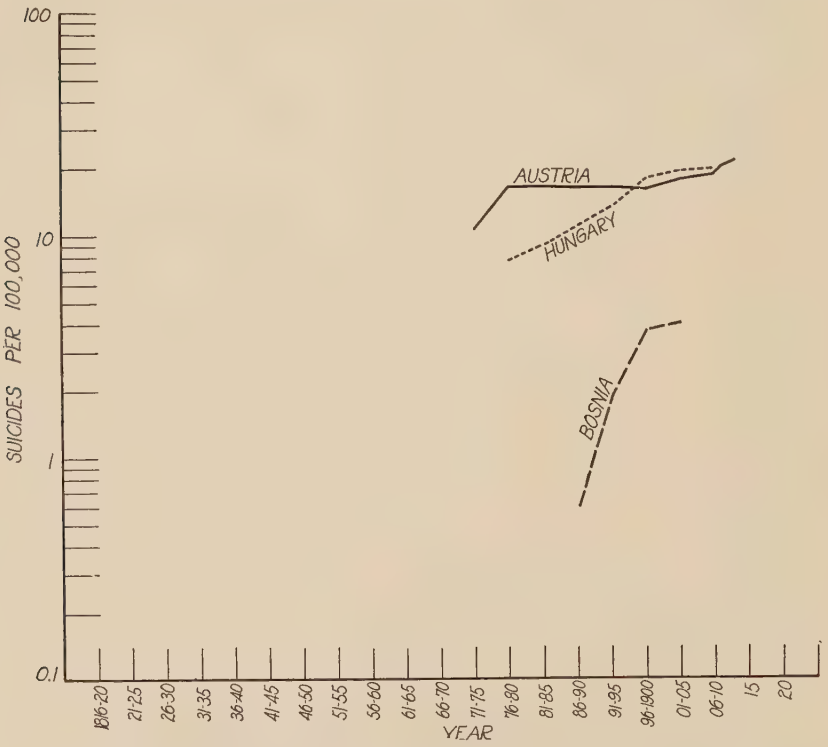

FIG. 7. Suicides per 100,000 in Austria, Hungary, and Bosnia.

There is, however, another movement characteristic of the nineteenth century which seems to synchronize better with the course of the suicide rates. This is the breaking away from traditional beliefs and sanctions, the increasingly individualistic viewpoint, the decrease in group spirit which characterized so much of nineteenth-century thought. In this respect Germany was far more modern in the period before her industrial transformation had begun than in the later

period when the cult of the *Reich* had acquired its extremely powerful quasi-religious influence on the German mind. In other countries too the end of the nineteenth century showed an increasing tendency towards socialism and mysticism, a breaking away from the individualistic and rationalistic viewpoints which had characterized the earlier part of the century. The occupational distribution of suicide shows the same influence. The professions and those of independent means, the two groups most affected by the individualistic and rationalistic movement, have high suicide rates, while farmers and other outdoor manual laborers, groups generally conservative in their habits of thought, show low rates. It is, therefore, quite probable that decrease in the group spirit is a factor in the increase of the suicide rate.

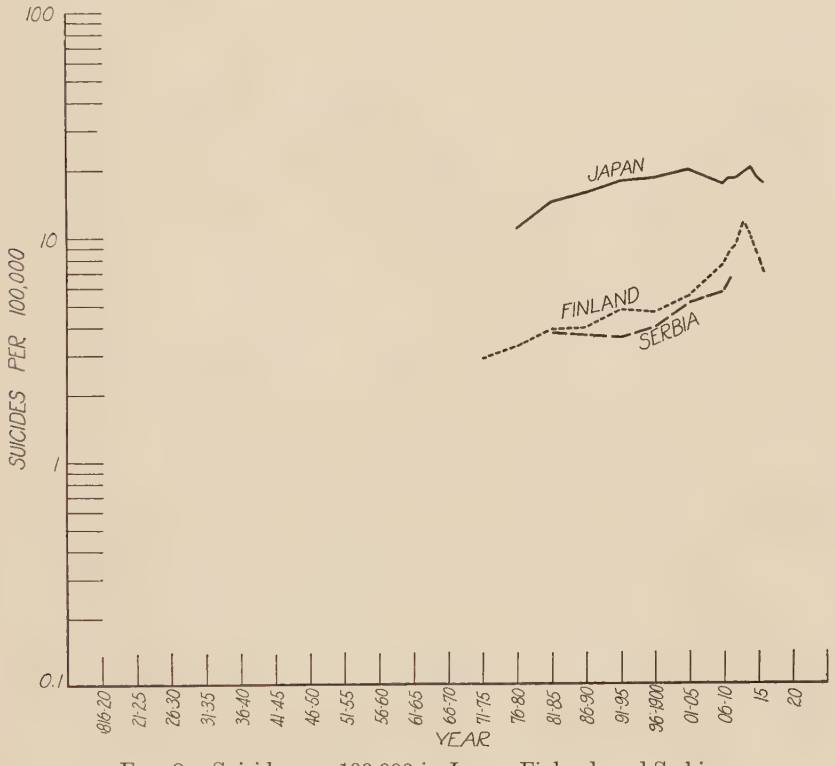

FIG. 8. Suicides per 100,000 in Japan, Finland, and Serbia.

The only countries which show any long-continued decline of the suicide rate are Norway and Denmark. This decline, which dates

in the case of Norway from 1856 and in that of Denmark from 1866, was noticed by Morselli and Rehfisch, and, in the case of Norway, was attributed by them to the Government restriction on the sale of alcohol, but this seems doubtful as Sweden, where the regulations in regard to the sale of alcohol are of much the same character, shows a general upward trend of the suicide rate.

Those countries for which rates are available for the years since 1913 show a sharp decline during the period of the European war, followed in the case of England by a post-war rise which has brought it nearly to the pre-war level. This effect of wars in reducing the suicide rate has been frequently noted before. In Table I, Massachusetts in 1861–1865 and Prussia and Saxony in 1871–1875 show decreases, but the phenomenon is not always noticeable with the five-year grouping. That it is a real decrease of the specific death rates and not a mere decrease of the crude death rate by the withdrawal from the civilian population of a large proportion of the males, who are more addicted to suicide than the females, is shown for England and Wales in the section on the influence of age on suicide, and is also apparent from the decrease in the suicide rates of neutral countries, in which of course the composition of the civilian population was not changed to any marked extent by the withdrawal of troops. There can be little doubt that war reduces the suicide rate by giving people something to think about outside themselves, by stimulating the patriotic emotions, in a word by increasing the group spirit. It certainly does not act by any decrease in the industrialization of a country or in the complexity of the environment. War involves the speeding up of factories, an increase of risk in commercial enterprise, an environment with many novel complexities,—all the attributes of the industrial régime which are supposed to have caused the increase in suicide, yet war, instead of increasing suicide still farther, decreases it. The inference is plain. It is not industrialization but decay of the group spirit that is a factor in the increase of the suicide rate.

Table II, derived from the reports of the Registrar-General, gives the death rates from all causes for most of the countries represented in Table I. The trend of the rates since 1870 is as distinctly downward in a majority of cases as it is upward for suicide. In the section on motives of suicide we shall find that the proportion of suicides attributed to physical or mental illness is increasing in western Europe. Now illness, either physical or mental, is a fairly objective fact; an increase in the proportion of suicides attributed to it is therefore more likely to be significant than a change in the proportion attributed to

TABLE II.

Deaths from all causes per 1,000 inhabitants for various countries.

Country.	1851–1855.	1856–1860.	1861–1865.	1866–1870.	1871–1875.	1876–1880.	1881–1885.	1886–1890.	1891–1895.	1896–1900.	1901–1905.	1906–1910.
Australia	.....	....	....	....	.....	.....	15.7	14.8	13.3	12.7	11.7	10.7
Norway	.....	....	....	....	17.5	16.3	17.2	17.0	16.8	15.6	14.5	13.8
Denmark	20.3	20.9	20.3	19.7	19.5	19.4	18.4	18.7	18.6	16.4	14.8	13.7
Sweden	21.7	21.8	19.8	20.5	18.2	18.2	17.5	16.4	16.6	16.1	15.5	14.3
United States (Registration Area)	.....	....	....	....	.....	.....	....	....	.....	....	16.2	15.1
Netherlands	(25.5)	26.8	24.9	25.2	25.6	22.9	21.4	20.5	19.6	17.2	16.0	14.3
England and Wales	(23.0)	21.8	22.6	22.4	22.0	20.8	19.4	18.9	18.7	17.7	16.0	14.7
Scotland	.....	20.7	22.2	22.0	22.7	20.6	19.6	18.8	19.0	18.0	17.0	16.1
Belgium	(23.0)	22.2	22.6	23.9	23.3	21.7	20.6	20.2	20.1	18.1	17.0	....
Switzerland	.....	....	....	....	23.9	23.2	21.3	20.4	19.8	18.1	17.5	....
Ireland	.....	....	....	16.5	17.7	18.6	18.0	17.9	18.5	18.1	17.6	17.3
Finland	.....	....	....	....	.....	.....	22.2	20.0	20.5	19.0	18.6	17.4
Prussia	(29.2)	26.4	26.0	26.1	27.7	25.4	25.4	24.0	22.8	21.0	19.6	17.3
France	(25.1)	23.8	22.9	24.4	24.9	22.4	22.2	22.0	22.3	20.7	19.6	19.2
German Empire	.....	....	....	....	(27.9)	26.1	25.3	24.4	23.3	21.2	19.9	....
Japan	.....	....	....	....	.....	.....	....	20.6	21.1	20.7	20.9	....
Italy	.....	....	....	30.4	30.3	29.4	27.3	27.2	25.5	22.9	21.9	21.0
Serbia	.....	....	....	....	.....	.....	24.5	25.9	28.9	24.8	22.4	....
Austria	(37.1)	28.5	29.8	31.3	32.7	30.5	30.1	28.9	27.9	25.6	24.2	22.3
Roumania	.....	....	....	....	.....	.....	26.2	28.7	31.0	27.4	25.5	26.0
Spain	.....	....	29.3	30.9	.....	(30.5)	32.6	30.9	30.1	28.8	26.0	24.3
Hungary	.....	....	....	34.2	45.2	36.6	33.1	32.1	31.8	27.9	26.4	25.0

some other motive more dependent on the imagination of the recorder. We find, therefore, at the same time with a decrease in the general death rate an increase both in the suicide rate and in the proportion of suicides due to physical or mental illness. Either the state of health of the population is not improving in the same fashion as the general mortality, or the moral resistance to the effects of illness is decreasing. In the absence of satisfactory morbidity statistics it is difficult to decide which of these possible explanations is the true one, or whether both may be factors.

The order of the countries in Table II with respect to general death rate bears little relation to their order with respect to frequency of suicide. This is in accord with the low correlation between suicide and general death rate found in the second part of the paper for different cities within the United States. Suicide ranges from 0.2 to 1.4 per cent. of all deaths, causing in the United States in 1919 rather more deaths than typhoid fever, but fewer than appendicitis.

2. *Geographical and racial distribution.*

The geographical distribution of suicide rates is in general the same as when Morselli found that "in the center of Europe from the northeast of France to the eastern borders of Germany a suicidigenous area exists where suicide reaches the maximum of its intensity and around which it takes a decreasing ratio to the limits of the northern and southern states (p. 50)." The south of Europe is, however, no longer at the bottom of the scale. Spain is now on the same level with Scotland, Norway, and the Netherlands, while Italy stands above them. The lowest place is now held by Ireland, Saxony still stands at the top of the scale, with Prussia well up. Denmark has decreased and Sweden increased until their rates now stand at about the same level in the upper part of the scale, while Norway is near the bottom.

TABLE III.

Suicides per 100,000 in different races.

Danes	25.5	Southern Slavs	5.1
French (not including Walloons)	22.4	Italians	5.0
German*	20.2	Roumanians (in kingdom)	4.2
Swedes	10.7	Russians	3.0
English (including Welsh)	7.7	Spanish	2.4
Norwegians	6.7	Poles (in Russia)	2.2
Celts (not including Welsh)	5.5		

* Including Dutch, but not Flemish nor the German inhabitants of Bohemia, Moravia, Austrian Silesia, Hungary, and the Prussian districts of Mareinwerder, Posen, Bromberg, and Oppeln.

Krose (quoted in v. Mayr, 1917, p. 367) found the suicides per 100,000 inhabitants to be as shown in Table III for different races in the period 1881–1890.

In v. Mayr (1917, p. 368) are given the suicides per 100,000 in Hungary for the years 1901–1908 by mother tongue:

TABLE IV.

Suicides per 100,000 in Hungary by mother tongue.

Mother tongue.	Hungary proper.	Kingdom.
Hungarian	25.2	25.2
German	19.8	19.4
Slovak	9.8	9.8
Roumanian	8.3	8.3
Ruthenian	3.6	3.6
Croatian	8.5	6.8
Serbian	13.4	10.0
Other	30.6	27.9

Here again the Germans show a high rate and the Slavic nationalities a low one.

In these days when much is heard of Nordic and Alpine racial elements it will be of interest to examine the suicide rates from this point of view. Prussia, Denmark, Sweden, Norway, and the Netherlands are predominantly Nordic; Finland, Switzerland, Hungary, Austria, Saxony, Bavaria, and Belgium are a mixture of Nordic and Alpine; Bosnia and Serbia are predominantly Alpine; England and Wales, Scotland, and Ireland are a mixture of Nordic and Mediterranean; Spain and Portugal are predominantly Mediterranean, while France and Italy are a mixture of all three types. The unweighted means of the suicide rates of these different groups for 1901–1905 are as follows:

Nordic	13.6
Nordic and Alpine	17.5
Alpine	4.5
Nordic and Mediterranean	6.5
Mediterranean	3.5
Nordic and Alpine and Mediterranean	14.5

Thus the pure Alpine, pure Mediterranean, and Nordic and Mediterranean give low suicide rates, while the pure Nordic, Nordic and Alpine, and Nordic and Alpine and Mediterranean give high rates. In the latter class the distribution of suicide rates within the country,

the higher rates in the north of both France and Italy, show that it is not the Mediterranean but the Nordic and Alpine stocks which are responsible for the high suicide rates. It should also be noted that some of the pure Nordic countries, i.e., Norway and the Netherlands, show low rates.

That the national differences in the suicide rate persist among the foreign born in the United States is shown by Table V, which gives the suicides in New York City in the years 1906–1914 (not including 1909) per 100,000 inhabitants of each country of birth. The figures are based on the annual reports of the Department of Health of New York City.

TABLE V.

Suicides in New York City in 1906–1914 (not including 1909) by country of birth.

Country of birth.	Total suicides.	Population 1910.	Annual rate per 100,000.
Austria-Hungary (including Bohemia)	447	266,873	20.9
England	217	78,483	34.5
France	73	18,293	49.7
Germany	1,509	278,137	67.8
Ireland	320	252,672	15.8
Italy	289	340,770	10.6
Russia	578	484,193	14.9
Other foreign countries	479	224,936	26.6
United States	2,388	2,741,459	10.9

Here the order by country of birth is in general the same as that of the corresponding European populations. Italy, however, stands below Ireland, Austria-Hungary below England, and France well below Germany. It should be remembered that a large proportion of the Austro-Hungarians in New York City are Slavs and Jews, who have a lower suicide rate than Germans and Magyars. In every case the suicide rate for a given country of birth is higher in New York City than in the country itself. For Austria and Italy the excess is small, but the suicide rate for the French born in New York is more than twice that of France, for English and German born it is more than three times, and for Irish born more than four times that of their respective countries. Is this excess due to the difficulty of adjustment to a new environment, to the more individualistic attitude of a person in a foreign country, or to a specific greater tendency to suicide among the more energetic and adventurous strains from which immigrants

are drawn? If the latter were the case, we should expect some portion of the excess to be passed on to later generations, i.e., the suicide rate of the native born to be greater than that of the countries whence they were derived. Yet the rate for native born in New York City is on the whole low for an urban rate. We cannot, therefore, consider the figures for New York City as supporting this suggestion.

There is a wide variation in the suicide rates of Asiatic peoples As we have seen, the Japanese rate is high. In China also, although we have no numerical data, suicide, according to Matignon, is very frequent. In India, on the other hand, suicide rates are low, v. Mayr (1917, p. 267) giving the suicides per 100,000 inhabitants in the various provinces of India in 1907 as follows:

TABLE VI.

Suicides per 100,000 in India, 1907.

Central Provinces	8.1	Bombay	2.2
Agra and Oudh	6.4	Punjab	1.6
Bengal	6.2	Burma	1.2
East Bengal and Assam	4.1	Northwest Provinces	0.8
Madras	4.0	Whole Empire	4.8

The geographical distribution of suicide in the United States Registration Area for the years 1915–1919 inclusive is given in Table VII. Only those states are included which have been in the Registration Area since 1915.

TABLE VII.

Mean annual suicides per 100,000 in registration states, 1915–1919.

State.	Rate.	State.	Rate.	State.	Rate.
California	28.7	Michigan	12.6	Pennsylvania	11.5
Colorado	14.9	Minnesota	13.4	Rhode Island	12.8
Connecticut	15.7	Missouri	16.0	Utah	10.6
Indiana	14.2	Montana	20.5	Vermont	15.7
Kansas	11.0	New Hampshire	14.9	Virginia	7.7
Kentucky	8.4	New Jersey	14.2	Washington	16.5
Maine	14.5	New York	14.8	Wisconsin	13.2
Maryland	12.6	North Carolina	4.2		
Massachusetts	12.8	Ohio	13.6		

In general the southern states have low rates and the far western states high rates.

3. *Seasonal distribution.*

Von Mayr (1917, p. 283) quotes the following table from Bodio, in which allowance is made for the unequal lengths of the months. Figures in italics are maximum and minimum values.

TABLE VIII.

Distribution by equalized months per 1,200 suicides.

	Italy, 1889–1893.	France, 1887–1891.	Switzerland, 1889–1893.	Prussia, 1889–1893.	Saxony, 1888–1889, 1894.	Sweden, 1889–1893.	Norway, 1887–1890.	Denmark, 1890–1894.	Finland, 1888–1892.	Roumania, 1886–1890.	Japan,	
											1888–1892.	1896–1905.
January	82	85	*65*	*72*	72	*74*	74	*70*	107	82	*74*	78
February	94	83	83	85	81	76	*65*	79	95	*62*	76	79
March	98	100	92	97	104	87	92	105	95	82	94	94
April	109	115	*128*	118	115	123	101	115	110	125	115	112
May	124	122	125	*126*	125	123	129	*145*	*118*	*144*	*129*	*122*
June	*132*	*128*	125	125	*138*	*135*	*157*	128	111	130	117	117
July	125	121	119	119	126	108	111	119	107	139	*125*	*128*
August	103	101	101	106	109	108	111	100	107	115	123	121
September	95	95	106	101	97	101	129	94	111	101	106	95
October	85	92	103	96	96	106	83	100	83	82	83	89
November	80	85	81	82	78	85	74	75	*73*	76	79	80
December	*73*	*73*	72	73	*59*	*74*	74	*70*	83	*62*	79	*76*

TABLE IX.

Number of suicides occurring in each equalized month in 10,000 suicides.

	France, 1827–1876.	Prussia, 1885–1900.	Saxony, 1875–1889.	Württemberg, 1846–1879.	Württemberg, 1889–1893.	Baden, 1881–1900.	Switzerland, 1884–1893.	Italy, 1864–1876.	Denmark, 1896–1905.	Simple Mean.		Australia, 1890–1910.
January	690	625	629	547	658	676	637	610	618	632	July	749
February	719	688	696	805	742	664	744	771	629	718	Aug.	846
March	851	803	817	848	800	864	749	827	713	808	Sept.	784
April	955	982	987	896	983	903	973	995	964	960	Oct.	910
May	1,018	1,018	1,040	998	*1,009*	972	1,025	1,121	1,135	1,037	Nov.	848
June	*1,092*	*1,053*	*1,088*	*1,134*	950	*1,059*	*1,078*	*1,216*	*1,207*	*1,097*	Dec.	*973*
July	1,053	997	1,010	1,063	983	991	1,039	1,023	1,072	1,026	Jan.	900
August	871	907	927	961	892	896	871	868	893	898	Feb.	849
September	757	836	813	769	833	805	832	714	740	789	March	832
October	744	787	758	742	775	803	810	641	762	758	April	793
November	643	692	664	717	867	730	659	610	688	697	May	796
December	*607*	*612*	*571*	*520*	*508*	*637*	*583*	*604*	*579*	*580*	June	*720*
	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000		10,000

In every one of the European countries except Switzerland the maximum is in May or June. There is no apparent connection of the month in which the maximum occurs with the latitude of the country, on which of course depends the march of the seasons. In Japan in both periods considered there are two maxima, one in May and one in July. The minima come generally in either December or January. Norway, Roumania, Saxony, and Denmark show unusually large amplitudes.

Table IX, given by Knibbs (1912), shows in general the same features for the European countries. Australia, in the southern hemisphere and with a temperature range about half that of Europe, has a maximum of suicides in the southern summer, a minimum in the southern winter, and an amplitude about half that of the European distributions.

TABLE X.

Distribution by equalized months per 1,200 suicides for New York City, 1871–1912.

January.....94	April.....112	July.....101	October.....94
February.....93	May.....114	August..... 93	November....96
March.....98	June.....111	September... 99	December.....95

Table X, calculated from data in the 1911–1912 report of the New York City Department of Health, shows a small seasonal variation with the highest incidence in the late spring and early summer. Urban suicides, as we shall see later, are less affected by the course of the seasons than are rural. It is difficult to say how far the low figure for August may be due to the absence of many people from the city on vacations.

For New England, Dewey found the maximum of suicides in April and the minimum in December.

Table XI, calculated from 1,066 suicides given by Patel, shows the distribution of suicides by months in Bombay for the years 1895 to 1907.

TABLE XI.

Distribution by equalized months per 1,200 suicides in Bombay.

January..... 90	April..... 94	July.....110	October.....108
February.... *59*	May..... 95	August.....105	November... 95
March.....102	June.....*121*	September...*121*	December....100

Bombay shows a rather even distribution, except for an abrupt drop in February, with maxima in June and September. This even distribution probably reflects the slight seasonal changes of the tropics as well as the effect of urban conditions.

Von Mayr (1917, p. 284) quotes from Gaedeken the percentage distribution of suicides by seasons according to mode of death for males; also for both sexes in Copenhagen and country districts of Denmark, in Norway, and in Serbia.

TABLE XII.

Percentage distribution of suicide by seasons.

	Denmark, 1876–1905.							
	Hanging.	Drowning.	Fire-arms.	Poison.	Copenhagen.		Country Districts.	
	Males.				Males.	Females.	Males.	Females.
January–March	20.3	15.2	25.9	26.0	23.1	23.0	19.0	18.5
April–June	33.2	34.8	26.9	32.1	30.7	26.6	34.1	31.3
July–September	26.4	28.9	24.3	22.6	23.9	23.8	27.5	28.6
October–December	20.1	21.1	22.9	19.3	22.3	26.6	19.4	21.6
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Absolute numbers	10,242	1,043	799	272	2,770	675	7,738	2,272

	Norway, 1866–1900.		Serbia, 1893–1905.	
	Males.	Females.	Males.	Females.
January–March	19.9	19.6	23.2	18.8
April–June	32.6	34.2	31.3	37.8
July–September	27.4	26.9	26.1	28.9
October–December	20.1	19.3	19.4	14.5
	100.0	100.0	100.0	100.0
Absolute numbers	13,527	1,013	1,052	506

From this table it is evident that the seasons have the greatest influence on suicides by drowning, and the least on those by the use of

firearms, and that their effect is greater in the country than in the city. Comparing the sexes, the seasonal effect is greater in Denmark among the males, but in Norway and Serbia among the females.

Durckheim and Ogle attribute the increase of suicide in the late spring to a more active movement of life with the lengthening days. This may be true of rural districts, especially of those in northern climates where the snow prevents as ready communication in the winter as in other seasons and each household is more or less isolated. But it can hardly be said that in the average city the activity of life is greater in May or June than in December, yet we have seen that the effect of the seasons, although not so large in the city as in the country, is yet readily perceptible.

Dexter (1904) has studied the effect of weather on suicide on the basis of 2,946 suicides and attempted suicides in New York City and 260 in Denver, Colorado. He concluded that "Suicide is most prevalent in the late spring and the summer months; is excessive at both extremes of temperature, and somewhat above the normal for days of moderate heat; is excessive in medium pressure of the air, and deficient for the extremes of pressure; increases with regularity as humidity and wind increase from a deficiency for low readings of both; is excessive for clear, dry days."

TABLE XIII.

Percentage distribution of suicide by days of the week in Prussia.

	Male.		Female.		Both sexes.	
	1907.	1908.	1907.	1908.	1907.	1908.
Sunday	12.3	12.9	13.8	14.0	12.7	13.1
Monday	16.3	15.7	15.0	14.6	15.9	15.4
Tuesday	16.2	14.6	14.6	14.3	15.8	14.6
Wednesday	14.7	14.8	13.5	13.8	14.4	14.5
Thursday	14.1	14.7	16.4	14.2	14.7	14.6
Friday	14.0	13.8	14.6	14.4	14.2	14.0
Saturday	12.4	13.5	12.1	14.7	12.3	13.8

Table XIII, which is due to v. Mayr (1917, p. 289) and is based on 15,133 cases, shows for males a decline from Monday to the following Sunday. The female suicides show a sharp rise on Thursday in 1907

and but little change from one day of the week to another in 1908, but the distributions are probably based on too few cases to be certainly significant. In both years the females show a greater tendency to Sunday suicide than the males. The same fact was noted by Morselli in Guerry's table of the distribution of suicides in France.

Bailey gives a similar table for the United States, based on 29,344 cases: This shows in general the same decrease through the week as Table XIII. Sunday, however, shows a high suicide rate. Bailey's comment on the table is: "Monday is the favorite day, followed by Sunday. From Monday down to and including Thursday there is a gradual fall, but on Friday there is a sudden rise that cannot be easily explained. Saturday is, next to Thursday, the lowest day in the week. For those who have endured throughout the week, there is the pay day at hand followed by a day of rest. Among the males, Monday is preeminently the day for suicide; the money is spent, and the spirits are often depressed as a result of the artificial stimulation of Saturday night and Sunday. Females prefer Sunday to Monday, but both are extraordinarily high. Religious excitement may have an effect upon this, but nearly a third of the suicides on account of domestic troubles come on Sunday. The family is there together for the day, giving greater opportunity for quarrels, or the husband may be intoxicated and the home seem dreary to the females." It is conceivable that the greater proportion of suicides on Sunday in the United States than in Europe may be due to the lesser opportunities for Sunday recreation in the former.

TABLE XIV.

Distribution of suicides per 700 by days of the week in the United States.

	Both sexes.	Males.	Females.
Sunday	110.8	107.3	123.1
Monday	119.2	118.4	122.6
Tuesday	97.2	98.7	94.8
Wednesday	96.3	97.0	93.5
Thursday	88.2	88.4	87.6
Friday	96.6	98.6	89.5
Saturday	91.0	91.6	88.9

Table XV, due to v. Mayr (1917, p. 290), and Table XVI, due to Bailey, are difficult to compare, owing to the indefiniteness of the categories in the former. The Prussian figures, however, show a greater frequency

of suicide in the morning than in the afternoon, especially among women, whereas the American figures show the greatest frequency in the afternoon and evening.

TABLE XV.

Percentage distribution of suicides by time of day in Prussia, 1907 and 1908.

Time of day.	Males.		Females.		Both sexes.	
	1907.	1908.	1907.	1908.	1907.	1908.
Soon after sunrise	6.3	5.8	7.2	7.8	6.6	6.3
Morning	25.1	27.4	27.9	29.2	25.8	27.8
About noon	10.2	10.4	11.7	10.0	10.5	10.3
Afternoon	25.9	26.2	20.4	22.2	24.5	25.3
Evening	13.7	12.5	11.4	12.4	13.2	12.5
Night	18.0	17.7	21.4	18.4	19.4	17.8
Total cases	4,757	5,619	1,494	1,634	6,251	7,253

TABLE XVI.

Distribution by hour of day of 10,000 suicides in the United States.

Hour of day.	Both sexes.	Males.	Females.
12 P.M. to 3 A.M.	506	404	102
3 A.M. to 6 A.M.	789	642	147
6 A.M. to 9 A.M.	1,098	908	190
9 A.M. to 12 M.	1,294	1,013	281
12 M. to 3 P.M.	1,398	1,082	316
3 P.M. to 6 P.M.	1,450	1,115	335
6 P.M. to 9 P.M.	1,408	1,096	312
9 P.M. to 12 P.M.	1,592	1,202	390
Unknown	465	319	146
	10,000	7,781	2,219

4. *Influence of religion.*

In Table I we have seen that those countries of Europe in which the population is mainly of the Roman Catholic or Greek faith have for the most part low suicide rates. Ireland, Spain, Portugal, Italy, Bosnia, Serbia, and Roumania all stand low on the scale, while in

Bavaria and Austria the rates, although fairly high, are below those of north Germany. Most of the countries in which the suicide rate is highest, on the other hand, such as Saxony, Denmark, and Prussia, are preponderantly Protestant. It should be noted however that the relation is not invariable. Thus France, a Roman Catholic country, although one in which the church has lost its hold on large elements of the population, has a high rate, while Scotland, the Netherlands, and Norway, all Protestant countries, have low rates.

TABLE XVII.

Suicides per 100,000 of each confession.

	Roman Catholics.	Protestants.	Other Christians.	Jews.	Ratio of Protestant suicide rate to Roman Catholic (= 100).
Prussia:					
1849–1855....	5.0	16.0	13.1	4.6	322
1869–1872....	6.9	18.7	?	9.6	271
1891–1900....	9.3	24.7	22.7	24.1	261
1901–1907....	10.1	25.2	18.0	29.4	250
Bavaria:					
1844–1856....	4.9	13.5	?	10.6	276
1870–1879....	7.4	19.5	?	11.5	263
1880–1889....	9.5	22.2	?	18.6	234
1890–1899....	9.3	21.0	?	21.2	226
1900–1908....	10.2	22.1	?	25.3	217
Württemberg:					
1846–1860....	8.0	11.4	?	6.6	143
1873–1880....	13.5	17.7	?	9.8	131
1881–1890....	11.8	16.9	?	13.8	143
1891–1900....	11.2	15.5	?	26.3	138
1901–1907....	11.7	19.3	?	21.5	165
Baden:					
1864–1870....	12.1	15.9	32.1	9.5	131
1871–1880....	15.5	21.3	?	15.1	137
1881–1890....	16.0	23.7	?	22.2	148
1891–1900....	15.9	25.0	35.6	22.9	157
1900–1905....	16.9	26.8	52.3	26.9	159

We can examine the effect of religious adherence more exactly in the case of those countries which tabulate suicides according to their

faith. Table XVII from v. Mayr (1917, p. 345) shows for four of the chief German states in different periods the suicides of each confession per 100,000 of the same faith in the population.

In all cases the Protestant rates are appreciably above those of the Roman Catholics, but the excess is much greater in Prussia and Bavaria than in either Württemberg or Baden. In the two former countries, however, the ratio decreases in the later periods, while in the latter countries it tends to increase. In the earlier periods the Jewish rate is on the same level with the Roman Catholic, whereas in the later periods it is on a level with the Protestant, i.e., the Jewish rate has increased much more rapidly than either the Roman Catholic or the Protestant.

TABLE XVIII.

Suicides per 100,000 in Munich by confessions.

	Roman Catholic.	Protestant.	Ratio.
1881–1889	18.5	35.3	191
1890–1894	15.9	35.2	221
1895–1899	16.4	26.8	163

Table XVIII, from Rost (1904, p. 281), when compared with the figures for Bavaria in Table XVII shows the effect of urban conditions in increasing the suicide rate above that of the whole country. This increase is greater proportionally among the Roman Catholics than among the Protestants.

TABLE XIX.

Suicides per 100,000 of each confession in Hungary, 1901–1908.

	Hungary.	
	Proper.	Kingdom.
Roman Catholic	17.5	15.8
Greek-Catholic	8.1	8.1
Greek-Orthodox	9.9	9.4
Reformed	36.3	36.3
Evangelical	26.0	25.9
Unitarian	35.0	35.0
Jews	16.2	16.6
Total	19.1	17.7

Table XIX, from v. Mayr (1917, p. 347), shows that in Hungary the lowest suicide rates were among the Greek churches, followed by the Roman Catholics and Jews, with the highest rates among the Protestants.

In the various cases we see exemplified the same law: the conservative and authoritarian cults show lower suicide rates than the liberal denominations. We find this even among the various divisions of Protestantism, where as in Hungary they are given separately; the Evangelical church shows a lower rate than the Reformed or the Unitarian. The rapid increase in the Jewish rate accompanies a decay of the influence of orthodox Judaism. These are all further examples of the effect of the group spirit on suicide which we have already seen in the increase of the suicide rate during the nineteenth century and in its decrease during wars.

TABLE XX.

Suicides per 100,000 in Bombay by religions, 1883–1907.

	Mean annual suicides.	Mean population.	Suicide rate.
Hindoos	58.9	567,640	10.4
Mohammedans	10.3	157,484	6.6
Christians	4.5	45,828	9.8
Parsees	11.4	47,508	24.1

Table XX, calculated from the data of Patel, shows the suicide rates of adherents of different religions in Bombay. The low rates for Hindoos and Mohammedans accord with the low rates that we have already seen prevail through India as a whole. The much higher rates for Parsees than for other religions are noteworthy.

5. *Urban and rural life.*

The suicide rate, like the general death rate, is normally higher in urban than in rural communities. There is no reason, however, to infer a causal connection. As we have seen, the correlation of suicide rate with general death rate from city to city or from nation to nation is low. The higher urban rate is probably a result of the loosening of social ties characteristic of the city. Table XXI shows the urban and rural suicide rates of Finland for the two sexes.

In both periods urban conditions show a greater effect upon the suicide rate of the males than upon that of the females.

Table XXII shows that, while both urban and rural Swedish rates have increased during the past century, the lower rural rates have in-

creased more rapidly than the higher urban. A similar compensatory effect has already been noticed in comparing the increase in rates of different countries.

TABLE XXI.

Suicides per 100,000 of each sex in urban and rural districts of Finland.

	1891–1900.	1901–1910.
Male:		
Urban	20.2	23.4
Rural	6.3	8.8
Whole country	7.8	10.7
Female:		
Urban	3.3	4.3
Rural	1.6	2.2
Whole country	1.8	2.5
Both sexes:		
Urban	11.3	13.2
Rural	3.9	5.5
Whole country	4.8	6.5

TABLE XXII.

Suicides per 100,000 in urban and rural districts of Sweden.

	Rural.	Urban.	$\frac{\text{Urban}}{\text{Rural}}$
1821–1830	4.91	15.39	3.13
1831–1840	5.20	16.43	3.16
1841–1850	5.81	14.56	2.51
1851–1860	5.38	14.83	2.76
1861–1870	6.32	20.47	3.24
1871–1880	7.24	17.51	2.42
1881–1890	8.46	19.50	2.30
1891–1900	10.51	21.98	2.09
1901–1910	12.45	24.04	1.93

Table XXIII, from the mortality statistics of the Bureau of the Census, shows higher rates in urban than in rural areas for both white and colored. The colored, however, with their lower suicide rates, are relatively more affected by urban conditions than the whites.

TABLE XXIII.

Suicides per 100,000 by color for cities and rural parts of United States registration states.

	1914.	1915.	1916.	1917.
Cities in registration states, total	19.4	19.1	16.9	15.9
White	19.7	19.4	17.2	16.2
Colored	12.6	11.4	9.2	9.0
Rural part of registration states, total	12.8	13.3	11.0	10.3
White	13.1	13.5	11.6	11.0
Colored	6.8	7.7	3.3	3.1

6. *Sex.*

In occidental countries suicide is everywhere much more common among men than among women. Table XXIV, from v. Mayr (1917, p. 298), shows the change in the proportion of the sexes in various European countries.

In most of the European countries, as well as in Japan and Australia, the proportion of female to male suicides is increasing. In the British Isles, Scandinavia, Finland, and Serbia, however, it is decreasing. In general, except for Japan, which shows a high proportion of female suicides, the countries in which the proportion is increasing are those in which it is low, while the countries in which the proportion is decreasing are those in which it is high. Here again is shown the tendency of different countries to seek a common level.

Table XXV shows that the decline in the proportion of female suicides in Sweden dates from the beginning of the nineteenth century. The ratios given in Table XXIV for Sweden do not give the same values, as they do not take into account the proportion of the sexes in the population.

In the United States registration area in 1919 there were 37.2 female suicides to each 100 male.

We have seen from Table XXIV that the proportion of female suicides in Japan is greater than that of any European country. Table XXVI, from v. Mayr (1917, p. 300), shows that in India the female suicides exceed the male, being nearly three times as numerous in the case of Agra and Oudh. The more favorable social position of women in Burma is reflected in its lowered proportion of female suicides. This difference between occidental and oriental countries in the relative liability of the sexes to suicide shows that we must seek

its cause not so much in inherent sexual differences as in differences between either the environment or the mores of the sexes in the respective countries. Thus many of the female suicides in India are undoubtedly a survival in a modified form of the rite of suttee while

TABLE XXIV.

Female suicides per 100 males.

	1881–1885.	1886–1890.	1891–1895.	1896–1900.	1901–1905.
I. Increase in proportion of females with generally only slight variations:					
Roumania	....	....	31.7[a]	37.0	....
Russia	28.9	30.2	....	....	....
Japan	55.0[b]	59.0[c]	62.1	64.2	63.1
German Empire	24.5	26.0	25.1	26.9	27.3
Austria	26.1	27.3	29.2	27.9	29.1
France	26.1	27.4	27.0	30.0	30.2
Switzerland	17.2	20.1	17.7	20.4	20.4
Belgium	19.0	19.8	19.5	21.6	21.3
Netherlands[d]	21.7	24.1	21.8	25.2	30.5
Italy	23.6	23.6	23.5	26.2	26.5
Bulgaria	....	....	....	33.4[e]	34.1[e]
Spain	22.1	25.0	20.0	24.2	27.0[f]
Australia[d]	18.0	20.8	21.3	22.3	18.5
II. Decrease in proportion of females with variations:					
England and Wales	33.4	33.6	34.2	33.7	33.0
Scotland	47.2	40.4	41.1	35.0	34.7
Ireland	33.6	37.2	33.9	32.5	29.1
Norway	27.5	27.0	29.3	23.8	22.2
Finland	21.4	26.0	21.3	26.7	20.4
Denmark	28.7	26.3	28.3	26.3	28.1
Serbia	54.9	51.7	43.9	43.9	48.6
III. Constant decrease in proportion of females:					
Sweden	28.9	28.6	26.1	22.3	21.8

[a] 1893–1895.
[b] 1884–1885.
[c] 1886–1887 and 1889–1890.
[d] Instead of 1881–1885, etc., are used 1880–1884, etc.
[e] 1897–1901 and 1902–1906, respectively.
[f] 1901–1903.
[g] Not including West Australia for 1881–1885 to 1891–1895.

the low proportion of female suicides in Europe is due either to the more sheltered economic position of women as compared to men or their smaller degree of emancipation from the traditional bonds of thought and family ties.

TABLE XXV.

Suicides per 100,000 of each sex in Sweden.

	Male.	Female.	$\frac{\text{Female}}{\text{Male}}$
1781–1790	3.42	1.12	.33
1791–1800	3.85	1.23	.32
1801–1810	5.02	1.65	.33
1811–1820	6.86	1.82	.27
1821–1830	9.83	2.36	.24
1831–1840	10.37	2.45	.24
1841–1850	10.94	2.66	.24
1851–1860	10.28	2.69	.26
1861–1870	13.04	3.30	.25
1871–1880	13.94	3.72	.27
1881–1890	17.21	3.88	.23
1891–1900	21.24	4.84	.23
1901–1910	25.36	5.38	.21

TABLE XXVI.

Female suicides per 100 males in India, 1907.

Madras	134.4
Bombay	108.5
Agra and Oudh	293.3
Punjab	127.1
Bengal	177.1
Central Province	99.9
Burma	85.7
East Bengal and Assam	149.0
N.W. Border Provinces	183.0
Whole Empire	171.4

Table XXVII, from v. Mayr (1917, p. 304), shows the effect of urban and rural conditions on the sex ratio in suicide. In the first three columns are given the crude sex ratios at different periods, i.e., the female suicides per 100 males, without taking any account of differences in the proportion of the sexes in the populations of the various countries which would, of course, affect the absolute number of male and female suicides and hence their ratio. The last three columns give

TABLE XXVII.

Relation of female to male suicides in urban and rural communities.

	Female suicides to 100 male (crude sex ratio).			Ratio of female suicide rate to male (= 100). (corrected sex ratio)		
		1896–1900.	1901–1905.		1896–1900.	1901–1905.
Prussia	(1871–1874)					
Cities of more than 20,000 population	22.6	28.7	29.7	....	27.6	28.7
All cities	24.0	27.8	28.7	....	26.8	27.8
Rural districts	25.7	25.9	25.8	....	25.2	25.2
Saxony	(1859–1863)		(1903–1907)	(1859–1863)		(1903–1907)
Principal cities	21.8	....	34.3	20.8	....	31.9
Smaller cities	26.1	....	28.5	25.7	....	27.3
All cities	24.8	....	32.5	24.2	....	30.6
Rural	29.9	....	31.9	28.4	....	29.8
Italy	(1877–1878)					
Capitals of provinces	17.2	....	24.5	....	....	24.5
Capitals of circles, etc.	22.5	....	24.2	....	....	24.5
Other communes	32.7	....	28.6	....	....	28.6
Norway	(1856–1865)					
Urban	19.1	18.7	12.1	....	....	....
Rural	34.2	26.8	28.5	....	....	....
Denmark	(1865–1874)					
Copenhagen	26.8	22.7	24.6	23.3	19.2	20.5
All cities	29.2	23.7	27.5	27.7	20.8	23.8
Rural	30.1	29.0	32.8	29.8	29.0	33.0

the corrected sex ratio, i.e., the ratio of the female rate to the male, or the ratio that would obtain between the absolute numbers of male and female suicides if the populations were composed of 50 per cent. males and 50 per cent. females. This ratio is, of course, unaffected by dif-

ferences in the proportion of the sexes in the populations of the different countries and is, therefore, more valid for comparative purposes than the crude sex ratio. Prussia, Saxony, and Italy show increases in the proportion of female suicides in the cities. These increases are most marked in the larger cities, so marked in the cases of Prussia and Saxony as to reverse the former relation to the rural districts. Whereas formerly the higher suicide rates of the cities affected chiefly the males, making the proportion of female suicides smaller than in rural districts, the later figures show a larger proportion of female suicides in the cities than in rural districts. In Norway and Denmark the proportion of female suicides in the cities, which in the earlier period was already below that of the rural districts, especially in Norway, has declined still farther.

7. *Age.*

Table XXVIII, from Knibbs (1912), gives the age specific suicide rates of each sex for various countries. The last column, giving the unweighted mean of the countries for each age, is plotted in Fig. 9.

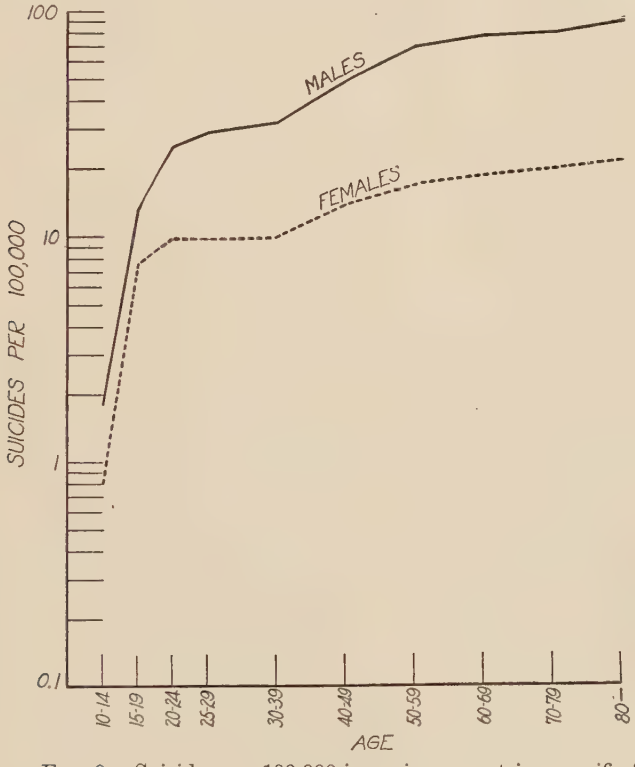

FIG. 9. Suicides per 100,000 in various countries, specific for sex and age.

TABLE XXVIII.

Suicides per 100,000 of each age group and each sex.

Age group.	Austria, 1896–1901.	Baden, 1891–1905.	Buenos Ayres, 1899–1908.	Denmark, 1886–1905.	France, 1893–1906.	Italy, 1901–1905.	Massachusetts, 1876–1885.	Prussia, 1891–1905, 1908.	Saxony, 1903–1907.	Sweden, 1891–1907.	Australia, 1891–1910.	Simple mean (not including Buenos Ayres).
						Males.						
10–14 ...	0.2	2.0	0.4	3.6	2.8	0.5	0.2	3.1	5.3	....	0.5	1.8
15–19 ...	16.5	16.1	17.5	14.4	16.1	7.1	3.5	18.6	34.1	4.2	3.2	13.4
20–24 ...	33.0	31.7	23.3	29.1	27.7	16.6	10.3	33.1	44.2	17.0	11.9	25.5
25–29 ...	38.4	37.6	26.4	31.3	37.4	13.8	13.6	31.5	48.2	23.8	19.0	29.5
30–39 ...	31.3	38.0	21.2	43.1	36.4	12.6	15.9	39.6	50.5	31.3	27.2	32.6
40–49 ...	42.3	59.4	27.6	70.0	53.7	16.5	23.0	65.4	92.9	44.2	40.3	50.8
50–59 ...	56.6	87.0	19.3	111.2	72.6	20.8	36.5	88.0	129.7	57.4	56.3	71.6
60–69 ...	58.5	98.7	18.7	118.3	86.9	22.3	44.5	95.1	158.9	58.8	60.2	80.2
70–79 ...	62.1	108.6	18.7	128.4	90.9	21.0	55.1	94.2	166.4	55.4	55.6	83.8
80– ...	62.1	140.8	18.7	121.0	95.4	20.2	26.4	110.5	278.0	46.8	44.3	94.6

TABLE XXVIII (*Continued*).

Age group.	Austria, 1896–1901.	Baden, 1891–1905.	Buenos Ayres, 1899–1908.	Denmark, 1886–1905.	France, 1893–1906.	Italy, 1901–1905.	Massachusetts, 1876–1885.	Prussia, 1891–1905, 1908.	Saxony, 1903–1907.	Sweden, 1891–1907.	Australia, 1891–1910.	Simple mean (not including Buenos Ayres).
						Females.						
10–14 ...	0.1	1.1	0.4	0.6	2.1	0.1	0.2	0.8	2.6	....	0.4	0.8
15–19 ...	9.2	5.7	23.5	8.2	13.1	3.4	1.6	9.8	19.2	2.0	4.0	7.6
20–24 ...	13.0	7.4	20.6	12.7	17.0	4.8	3.1	11.5	17.7	5.2	6.8	9.9
25–29 ...	12.2	8.0	12.0	9.4	24.4	4.0	4.3	9.0	16.0	5.4	5.3	9.8
30–39 ...	8.2	12.0	7.8	8.9	33.8	3.7	5.3	9.7	14.9	5.6	7.6	10.0
40–49 ...	8.6	14.9	5.6	17.8	34.2	3.7	5.6	13.4	24.3	8.4	8.6	14.0
50–59 ...	9.9	13.9	2.5	22.6	44.4	4.3	6.4	17.5	33.8	11.4	8.8	17.3
60–69 ...	9.9	18.4	2.5	27.9	51.5	4.2	8.2	19.3	30.2	11.5	8.7	19.0
70–79 ...	14.7	17.1	2.5	27.0	52.8	4.6	5.5	21.5	43.7	9.1	9.1	20.5
80– ...	14.7	17.1	2.5	38.6	52.6	3.8	2.4	25.9	55.7	8.9	5.7	22.5

In general the specific rates increase markedly with age but at a decreasing rate, the most rapid increase in both sexes being before the age of 23. From 23 to 35 years of age the suicide rate increases less rapidly in the male and remains stationary in the female. After 35 the rate of increase again becomes greater but is not so rapid as in the adolescent period, while after 55 it becomes still less rapid. The female rate comes nearest to the male from 15 to 19 years of age, at which period it exceeds the male rate in Buenos Ayres and Australia. This is the period at which illegitimate pregnancy is most important. From this time it increases less rapidly than the male rate until the age of 55, after which the increase in the male and female rates is about the same. Certain of the countries in the table show a falling of the suicide rate in old age. Thus in Italy, Sweden, and Australia the maximum rate for males is around age 65, while in Massachusetts the rate shows a sharp drop after 75. Among the females the Swedish rate declines after 65, and the Massachusetts and Australian rates after 75. For Buenos Ayres the male rate reaches its maximum about 45 and the female as early as 17.

TABLE XXIX.

Suicides by sex and age in Japan, 1904–1913.

Age group.	Population, December 31, 1908.		Mean annual suicides.		Suicides per 100,000.	
	Male.	Female.	Male.	Female.	Male.	Female.
10–15.....	2,556,770	2,496,140	76.2	57.2	3.0	2.3
15–20.....	2,251,990	2,180,410	403.9	468.3	17.9	21.5
20–25.....	2,089,490	2,042,140	712.0	491.8	34.1	24.1
25–30.....	2,003,680	1,984,580	548.0	322.4	27.3	16.2
30–35.....	1,875,290	1,812,840	409.6	238.7	21.8	13.2
35–40.....	1,473,890	1,406,860	364.5	197.9	24.7	14.1
40–45.....	1,445,080	1,362,960	359.3	168.4	24.9	12.4
45–50.....	1,114,500	1,061,470	391.5	180.8	35.1	17.0
50–55.....	1,176,720	1,121,520	424.2	182.8	36.0	16.3
55–60.....	1,008,040	987,954	479.2	188.7	47.5	19.1
60–65.....	801,663	812,608	439.4	201.5	54.8	24.8
65–70.....	550,661	593,058	356.3	201.6	64.7	34.0
70 up.....	649,769	810,333	548.6	461.4	84.4	56.9

Table XXIX, calculated from data in the official Japanese publica-

tions, shows the specific suicide rates for each sex in Japan. These differ from the European rates chiefly in a decline after about 23 years of age, in which period the European rates show for the most part merely a slowing up of their increase with age. This decline lasts in the males until about 33 years and in the females until about 43 years, after which the rates increase to the end of life. The female rate exceeds the male in the age period 15–20 and everywhere comes nearer to it than in most European countries.

TABLE XXX.

Suicides per 100,000 population in Denmark, 1896–1905.

Age groups.	Males.				Females.			
	Capital.	Other towns.	Rural.	Whole country.	Capital.	Other towns.	Rural.	Whole country.
10–20 yrs.....	10	6	6	7	5	2	4	4
20–30 "	50	21	23	29	11	7	8	8
30–40 "	71	35	27	38	11	7	7	8
40–50 "	130	78	48	71	24	14	14	16
50–60 "	180	100	82	102	23	19	19	20
60–70 "	169	113	94	107	33	34	29	31
70–80 "	151	108	104	110	22	27	33	30
80 and over..	90	88	112	107	24	36	35	34

TABLE XXXI.

Suicides per 100,000 population in Sweden, 1891–1900.

Age groups.	Males.			Females.			Both sexes.		
	Rural.	Urban.	Whole country.	Rural.	Urban.	Whole country.	Rural.	Urban.	Whole country
15–20 yrs.	3.2	8.2	4.1	2.3	2.4	2.3	2.8	5.2	3.2
20–25 "	10.5	32.0	15.4	5.9	5.7	5.8	8.2	18.0	10.6
25–30 "	17.6	37.9	22.4	5.1	7.1	5.6	11.3	21.0	13.8
30–40 "	21.9	57.4	30.1	4.4	6.3	4.9	12.8	29.2	16.9
40–50 "	31.2	84.9	42.2	7.0	11.7	8.0	18.6	44.0	24.1
50–60 "	40.4	112.3	52.8	11.2	15.7	12.2	25.1	55.9	30.9
60–70 "	46.9	111.8	55.7	10.9	11.9	11.0	27.8	50.0	31.4
70–80 "	45.9	97.0	51.0	6.5	12.2	7.5	24.6	39.7	26.7
Over 80..	42.9	....	42.6	8.4	....	8.2	22.6	....	21.6

Tables XXX and XXXI from v. Mayr (1917, p. 317) show the effect of urban and rural conditions on the specific suicide rates of Denmark and Norway. In Denmark, where Copenhagen is distinguished from the smaller towns, the latter resemble the rural districts much more than they do the metropolis. Urban conditions have a much greater effect in increasing the male than the female rates. In both sexes the influence of urban life is shown chiefly in the period from 20 to 50 or 60 years, while in old age the rural and small town rates are higher than the metropolitan, especially for females. In Sweden, which does not separate the large from the small towns, the effect of urban life is again greatest on the males, but this increase is more evenly distributed over the age periods. There is no excess of rural suicides in old age in either sex.

TABLE XXXII.

Suicides per 100,000 of each sex and age group in New York City.

Age group.	Male.			Female.		
	1885–1894.	1895–1904.	1905–1912.	1885–1894.	1895–1904.	1905–1912.
5–14	0.1	0.2	0.1	0.1	....	....
15–24	15.4	17.7	17.3	7.0	13.5	7.3
25–44	37.9	44.7	36.5	9.7	18.2	13.0
45–64	70.5	89.1	74.6	10.3	17.5	16.2
65 and over	83.0	109.0	90.3	14.6	20.2	19.6

Table XXXII, calculated from data in the 1911–1912 report of the Department of Health of New York City, gives suicide rates specific for sex and age for three periods. The variation with age is much the same as in the tables already given.

Table XXXIII, from the Registrar-General's report for 1917, shows the effect of the European war on the various age classes of England and Wales. The rates for the war period are based on the civilian population only, for which reason the figures for males of military age are not strictly comparable with the pre-war rates, as selection for military service may have involved unwittingly a positive or negative selection for suicide. The other rates are however comparable, and show for men of 45 to 74 a decrease of one half in the suicide rate, with a decrease of one third in the rates for women from

15 to 34. The rate for girls from 10 to 14 is based on too few instances to be significant. The effect of the war in reducing the crude death rates, which we have already noticed, is therefore not due merely to the transfer of a large proportion of the males with their high suicide rates from the civilian population to the army but represents a real change in the specific rates.

TABLE XXXIII.

Suicides per 100,000 of each sex and age group in England and Wales.

Males.

	1901–1910.	1914.	1915.	1916.	1917.	$\frac{1917}{1901-1910}$
All ages (standardized)	15.7	15.0	10.2	11.0	9.7	0.62
10–14	0.4	0.4	0.2	0.2	0.2	.50
15–19	3.6	3.8	2.1	....	....	....
20–24	9.1	7.9	7.1	....	....	....
25–29	15.2	15.6	9.4	....	....	....
35–44	25.2	24.8	16.5	....	....	....
15–44	14.4	14.5	10.1	11.6	10.3	.72
45–54	39.7	34.7	22.4	21.5	20.1	.51
55–64	52.3	51.2	36.5	29.2	25.7	.49
65–74	50.8	50.2	36.3	40.6	28.5	.56
75–84	38.3	36.0	33.8	31.8	32.2	.85
85	36.6	12.9	25.2	38.4	35.2	.96

Females.

	1901–1910.	1914.	1915.	1916.	1917.	$\frac{1917}{1901-1910}$
All ages (standardized)	4.7	4.5	4.5	3.8	3.5	0.74
10–14	0.3	0.2	0.2	0.2	0.4	1.33
15–19	3.4	2.7	3.6	3.2	2.2	.65
20–24	4.5	4.4	3.9	3.0	3.0	.67
25–29	5.6	5.0	4.0	3.8	3.8	.68
35–44	8.0	7.9	8.0	6.6	7.0	.87
15–44	5.6	5.3	5.0	4.3	4.3	.77
45–54	10.9	11.3	11.1	8.0	7.5	.69
55–64	10.9	10.6	12.3	10.2	8.6	.79
65–74	8.8	9.4	9.4	8.7	7.6	.86
75–84	5.1	4.7	6.4	6.4	5.5	1.04
85	3.7	2.4	....	4.7	2.4	.65

8. *Social status.*

Table XXXIV, from v. Mayr (1917, p. 321), shows the suicide rates of Sweden in two periods, specific for age, sex, and social condition. In both sexes and all ages the rates for the married are lower

TABLE XXXIV.

Suicides per 100,000 of each sex and social condition in Sweden.

Age groups.	Males.					
	Single.		Married.		Widowers.	
	1891–1900.	1901–1907.	1891–1900.	1901–1907.	1891–1900.	1901–1907.
15–20	4.1	4.3	....	....	....	....
20–25	16.0	19.5	9.0	11.6	....	....
25–30	30.6	32.2	9.7	13.1	....	166.3
30–40	55.0	57.2	18.5	21.7	74.4	42.6
40–50	86.2	91.3	32.4	35.9	85.6	89.0
50–60	112.6	135.0	42.4	50.6	84.6	91.3
60–70	121.2	111.9	40.5	48.2	90.5	101.4
70–80	97.7	102.3	35.3	43.3	67.9	82.3
80 and over	75.2	54.0	30.1	41.6	46.2	58.3
	Females.					
	Single.		Married.		Widowed.	
	1891–1900.	1901–1907.	1891–1900.	1901–1907.	1891–1900.	1901–1907.
15–20	2.3	1.7	....	...	....	....
20–25	6.7	5.3	....	...	....	....
25–30	9.0	7.5	1.9	2.2	....	....
30–40	7.6	8.5	3.3	4.9	13.6	21.8
40–50	11.4	13.4	6.6	6.5	12.7	18.0
50–60	12.3	12.5	11.1	9.2	16.1	13.2
60–70	12.0	17.5	10.5	9.6	11.5	13.6
70–80	9.8	15.3	7.1	8.4	7.1	11.5
80 and over	....	....	....	...	8.2	9.8

than those for single or widowed. The rate for widowed is in general higher than those for single up to about 40 years in males and about 60 in females, after which ages the single show the higher rates. There is in most cases an increase from 1891–1900 to 1901–1907, decreases occurring mainly in single males over 60, single females below 30, and married females from 40 to 70. The ratio of males to females is highest—about ten times as great—among the single from 50 to 60. The maximum rates are in most cases around 60.

TABLE XXXV.

Suicides per 100,000 of each sex and social condition in rural and urban districts of Sweden, 1891–1900.

Age groups.	Males.					
	Single.		Married.		Widowers.	
	Rural.	Urban.	Rural.	Urban.	Rural.	Urban.
15–20	3.2	8.2	....	....	....	....
20–25	10.8	33.3	7.1	15.9	....	....
25–30	24.2	50.3	7.7	16.4	....	....
30–40	41.3	94.1	13.2	37.2	58.4	117.4
40–50	66.1	145.2	24.2	66.5	61.4	163.1
50–60	84.9	202.0	32.7	92.1	69.4	147.7
60–70	101.8	194.1	35.0	78.6	75.2	187.2
70–80	90.5	131.3	30.5	79.6	63.2	115.1
80 and over	79.0	....	25.8	....	49.3	....
	Females.					
	Single.		Married.		Widowed.	
	Rural.	Urban.	Rural.	Urban.	Rural.	Urban.
15–20	2.3	2.5	....	....	....	....
20–25	7.0	6.0	....	....	....	....
25–30	8.7	9.8	1.6	2.8	....	....
30–40	7.5	7.9	2.9	4.7	13.8	....
40–50	10.0	14.1	5.6	10.7	13.7	10.6
50–60	8.2	20.1	10.9	12.4	15.5	17.7
60–70	11.4	13.0	10.3	12.0	11.7	11.1
70–80	9.5	10.5	6.1	16.1	6.3	11.5
80 and over	....	....	....	....	8.4	....

Table XXXV, from v. Mayr (1917, p. 321), shows the Swedish rates specific for age, sex, and social condition for urban and rural areas. The increase under urban conditions is quite generally distributed among the various ages and social conditions. Small increases under urban conditions or in some instances slight decreases characterize single females under 50, married women from 50 to 70, and widows under 70. The increase under urban conditions is in general somewhat greater among married men and widowers than among single men. Among single men the effect of urban conditions diminishes with advancing age, whereas with married men the greatest effect is in the period from 30 to 60.

Table XXXVI, from v. Mayr (1917, p. 322), shows the suicide rates for Denmark specific for age, sex, and social condition. The results are much the same as in Table XXXIV except that in the older as well as the younger ages the widowed in both sexes show in general a higher rate than the single. The same may be said of Table XXXVII, from v. Mayr (1917, p. 322), showing the specific rates for Norway.

TABLE XXXVI.

Suicides per 100,000 of each sex and social condition in Denmark.

Age groups.	Males.			Females.		
	Single.	Married.	Widowers.	Single.	Married.	Widowed.
20–25 years	28	4	...	12	2	..
25–30 "	47	15	...	11	4	..
30–35 "	69	21	69	13	4	24
35–40 "	77	33	51	11	6	33
40–45 "	115	47	91	29	9	16
45–50 "	121	70	179	34	17	20
50–55 "	148	78	163	40	17	24
55–60 "	186	91	195	16	17	23
60–65 "	110	90	181	15	23	45
65–70 "	106	82	162	23	33	35
70–75 "	114	82	172	33	26	37
75–80 "	...	75	141	47	12	29
80 and over	...	86	121	..	37	35

Table XXXVIII, due to Durckheim (1897), shows the specific rates for France. Here again the rates for married are lower than for single or widowed, except for males under 20, in which class the

married rate is nearly five times the single. The figures for Norway show an excess, although not such a marked one, for married men from 15 to 25, while the other countries already considered show no rates for married men under 20. The difficulty of providing for a family at such an early age is sufficient to account for this feature. In France, widowers have at all but one age period a lower rate than single men, whereas at most age periods widows have a higher rate than single women.

TABLE XXXVII.

Suicides per 100,000 of each sex and social condition in Norway, 1881–1900.

Age groups.	Males.			Females.		
	Single.	Married.	Widowed and divorced.	Single.	Married.	Widowed and divorced.
10–15 years	0.6	....	....	0.14	...	....
15–25 "	4.1	6.7	....	1.2	0.8	....
25–35 "	16.2	6.2	27.6	3.6	1.4	3.6
35–45 "	29.8	10.8	31.4	4.1	2.9	5.8
45–55 "	43.9	20.8	52.8	8.8	5.2	11.6
55–75 "	50.6	25.4	54.1	9.0	8.1	6.2
Over 75	63.0	26.7	42.3	5.1	5.4	7.1

TABLE XXXVIII.

Suicides per 100,000 of each age group by sex and social condition in France, 1889–1891.

Age groups.	Males.			Females.		
	Single.	Married.	Widowed.	Single.	Married.	Widowed.
15–20	11.3	50.0	....	7.9	3.3	33.3
20–25	23.7	9.7	14.2	10.6	5.3	6.6
25–30	39.4	12.2	41.2	15.1	6.8	17.8
30–40	62.7	22.6	56.0	12.6	8.2	20.5
40–50	97.5	34.0	72.1	17.1	10.6	16.8
50–60	143.4	52.0	97.9	20.4	15.1	19.9
60–70	176.8	63.5	116.6	18.9	15.8	25.7
70–80	198.3	70.4	128.8	20.6	20.9	24.8
Over 80	157.1	77.0	115.4	17.6	11.0	24.0

TABLE XXXIX.

Suicides per 100,000 of each age group by sex and social condition in Switzerland.

Age groups.	Single.			Married.			Widowed.			Divorced.	
	1881–1890.	1891–1900.	1901–1905.	1881–1890.	1891–1900.	1901–1905.	1881–1890.	1891–1900.	1901–1905.	1891–1900.	1901–1905.
Males.											
10–14	....	....	1.3	....	....	....	....	....	....	....	....
15–19	14.4	10.5	12.8	....	....	....	....	....	....	....	....
20–29	42.0	39.3	36.4	31.0	20.8	19.1	44.2	45.5	185.0	129.3	540.5
30–39	77.7	79.6	77.3	39.8	35.8	34.5	103.0	119.0	137.9	265.1	151.4
40–49	99.0	102.2	126.1	57.6	50.8	55.9	157.3	143.7	163.6	261.1	305.5
50–59	108.7	119.1	136.1	69.7	77.0	80.0	176.0	155.1	169.4	292.2	503.9
60–69	101.1	103.1	131.5	68.4	68.8	86.9	127.8	166.4	182.1	318.5	448.1
70–79	97.1	99.1	93.9	51.2	59.3	56.1	100.1	112.2	140.8	301.9	719.0
80 and over	70.8	61.3	68.6	28.6	39.6	63.9	86.1	73.4	56.7	....	....

TABLE XXXIX (*Continued*).

Age groups.	Single.			Married.			Widowed.			Divorced.	
	1881–1890.	1891–1900.	1901–1905.	1881–1890.	1891–1900.	1901–1905.	1881–1890.	1891–1900.	1901–1905.	1891–1900.	1901–1905.
					Females.						
10–14	....	....	0.4	....	....	....	....	....	....	....	....
15–19	4.2	4.9	4.0	....	13.2	....	....	....	....	....	....
20–29	9.9	8.9	9.8	5.1	4.7	7.8	31.6	27.7	....	51.8	....
30–39	13.1	12.8	13.3	9.1	8.0	8.5	12.9	16.4	13.7	21.2	38.7
40–49	11.3	16.8	15.6	9.0	9.7	13.1	16.9	20.2	18.6	17.6	59.3
50–59	10.5	14.3	17.2	12.8	12.1	18.7	15.3	14.6	18.3	48.1	26.4
60–69	12.1	8.4	9.6	11.9	10.5	10.7	17.4	17.2	15.3	37.5	42.8
70–79	12.1	8.9	6.7	7.4	10.9	13.6	13.7	10.0	16.1	24.0	39.2
80 and over	....	20.2	....	....	65.9	....	8.8	10.4	19.7	....	....

Table XXXIX, from v. Mayr (1917, p. 323), shows the specific rates for Switzerland for three periods. There are increases among single males from 40 to 69, among single females from 40 to 59, among married males of 50 and above, and among married females, widowers, widows, and divorced men and women for most ages. The married are below the single, widowed, or divorced, except for wives under 20 and over 60 in the period after 1890. For both sexes the divorced have in general higher rates than the widowed, and the widowed higher rates than the single. The low rates for married which are shown in these tables form another illustration of the effect of the group spirit on suicide.

TABLE XL.

Suicides per 100,000 of each class in France.

	1861–1868.	1889–1891.
Married men with children	20.5	33.6
Married men without children	47.8	64.4
Married women with children	4.5	7.9
Married women without children	15.8	22.1
Widowers with children	52.6	93.7
Widowers without children	100.4	125.8
Widows with children	10.4	18.6
Widows without children	23.8	32.2

Table XL, quoted by v. Mayr (1917, p. 324) from Bertillon and Durckheim, shows the marked prophylactic effect of the presence of children in the family on the suicides of their parents. This effect is greater among women than men, and among the married than the widowed, but is diminishing in all classes, i.e., the suicide rates of parents are increasing more rapidly than those of non-parents. All this accords with what we might expect *a priori*. The childless woman feels the lack of children far more than the childless man, while conversely the woman with children has her attention centered on her children and consequently directed away from herself more than the father. On the other hand, the married woman does not customarily bear the economic burden of children to the same extent as the married man, the widower, or the widow; the prophylactic effect is therefore not counteracted by financial worry. Finally, the decrease in the prophylactic effect is explicable on the basis of the loosening of the family bond which has taken place in the period under consideration. Similar are the findings of Durckheim, who, on combining the departments of France into groups on the basis of their suicide rate, found that the mean number of persons per family bore

an inverse relation to the suicide rate, i.e., as the suicide rate decreased the mean size of family increased. The figures are shown in Table XLI.

TABLE XLI.

Relation between suicide rate and size of family in France.

Suicides per 100,000 population, 1878–1887.	Mean persons per 100 families, 1886.
43–38	347
30–24	360
23–18	376
17–13	393
12– 8	418
7– 3	434

There is however a factor entering into these figures which was not of so much importance in Table XL, since it did not take into consideration the number of children to a marriage but only whether or not it was entirely childless. Now it is well known that the size of family is much smaller in upper and middle classes than in the lower. We shall also see in the section on occupation that the upper and middle classes have in general a higher suicide rate than the lower class. A part of the connection in Table XLI between suicide rate and size of family may therefore be an indirect relation, due to the connection of each with class differences.

9. *Occupation.*

The occupation of the deceased is not tabulated in many countries and in many cases where this is tabulated there are no comparable occupation statistics for the population to make possible the calculation of rates. The study of the effect of occupation not only upon the disposition to suicide but upon physical diseases of various kinds, a study of the greatest interest and importance, must therefore depend on a comparatively small volume of material.

TABLE XLII.

Suicides per 100,000 of each occupation group in Italy, 1897–1911.

Priests and monks	6	Printers and binders	34
Farmers, foresters, shepherds	9	Soldiers and sailors	37
Fishers and mariners	11	Physicians	41
Spinners and weavers	20	Police and inspectors	43
Professors and teachers	24	Capitalists	48
Servants	30	Hotel and cafe personnel	48
Barbers	34		

Table XLII, from the official Italian publications, gives the suicide rate for various occupations. Priests and monks show the lowest rate and the outdoor occupations stand second. The professions are represented by only two headings, professors and teachers with a fairly low rate, and physicians with a high rate. Their mean is higher than that of the two entries belonging to the artisan class, spinners and weavers, and printers and binders. Soldiers and sailors and police show high rates but the highest place is held jointly by capitalists and hotel and cafe personnel. This classification includes only a portion of the total range of occupations. Let us see what results a broader classification yields.

TABLE XLIII.

Suicides per 100,000 of each occupation group in Prussia.

	Males.		Females.		Both sexes.	
	1895.	1907.	1895.	1907.	1895.	1907.
Agriculture	22.5	22.0	5.6	5.9	13.7	13.4
Forestry	....	22.1	....	2.5	....	12.9
Mining	12.8	10.9	1.2	1.2	7.5	6.6
Manufacturing	28.3	27.9	4.3	5.4	17.0	17.6
Commerce	42.6	37.4	6.5	7.9	24.2	22.8
Domestic service	51.8	52.1	17.1	19.3	20.6	21.6
Hired migratory laborers (not including agricultural laborers)	210.9	318.2	40.4	74.3	124.3	197.0
Public service	28.4	29.8	6.3	6.8	19.6	20.3
Without occupation (including inmates of institutions)	72.3	63.9	31.5	31.0	47.7	44.2

Table XLIII, from v. Mayr (1917, p. 330), gives by sexes for two periods the specific suicide rates for broad occupation groups in Prussia. Here, mining, which is not represented in the Italian figures, shows the lowest rate, followed by agriculture and forestry, manufacturing, public service, commerce, domestic service, and without occupation. By far the highest rates are those of hired migratory laborers, which moreover are the only rates showing any large increase between the two periods. In general the males show a slight tendency downward while the females tend upwards.

TABLE XLIV.

Suicides per 100,000 of each occupation group in Bavaria.

	1891–1901.	1902–1906.
Agriculture and forestry	15.7	13.7
Mining and manufacturing	31.5	34.8
Commerce	41.7	48.0
Personal service	47.0	19.0
Care of the sick	41.5	18.9
Military and police	45.3	31.3
Education	27.9	23.0
Officials	44.5	45.4
Church officials	12.5	13.2
Art, literature, and journalism	48.0	56.7

Table XLIV, from v. Mayr (1917, p. 331), gives suicide rates by occupation for Bavaria. Here as in Italy church officials stand at the bottom of the scale, with agriculture and forestry next, and education fairly low. Military and police, care of the sick, and personal service, which have high rates in the earlier period, show remarkable decreases in 1902–1906, especially the two latter. Commerce and officialdom show high rates in both periods, while art, literature, and journalism head the list.

TABLE XLV.

Suicides per 100,000 in various male occupations in Australia, 1910–1912.

Occupation.	Population 1911 Census.	Mean annual suicides.	Rate per 100,000.
Professional	91,638	26.7	29.1
Domestic	48,235	25.7	53.3
Mercantile	236,499	71.7	30.3
Transport and communication	152,554	29.0	19.0
Manufacturing	257,988	46.7	18.1
Building and construction	111,704	23.3	20.9
Indefinite industrial	77,918	106.3	136.4
Agricultural	277,232	47.7	17.2
Pastoral	143,591	25.7	17.9
Mines and quarries	105,726	28.3	26.8
Other primary producers	43,719	5.7	13.0
Independent means	13,939	8.0	57.4
Dependents (largely children)	706,773	5.0	0.7

Table XLV, computed from data in the Australian Official Year Book, gives suicide rates by occupations in Australia. Agricultural and pastoral pursuits, as well as manufacturing, transport, and building, show low rates. Unlike Prussia, Australia shows a higher rate for mining than for any of the before-mentioned occupations. Professional and mercantile occupations stand well up on the scale, with domestic service (male) and persons of independent means still higher, while by far the highest rate of all is given by indefinite industrial occupations, the very class of unskilled labor with an uncertain tenure of employment, which we have seen to exhibit so high a rate in Prussia.

Table XLVI, from Ogle (p. 108), gives the suicide rate among males for various occupations in England and Wales, corrected for age. Soldiers, who showed high rates in previous tables, head the list. Next come inn servants and innkeepers, who in Italy, where they were distinguished from other occupations, also showed a high rate. Ogle finds the explanation of the high rates of these occupations, as well as of butchers, fishmongers, greengrocers, domestic servants, commercial travellers, brokers, and agents, in sedentary or semi-sedentary habits combined with intemperance. Among the professions, physicians and lawyers show high rates. Indoor artisans and shopkeepers occupy a middle position, while "at the bottom of the list come, with the single and readily intelligible exception of the clerical profession, occupations that entail severe manual labor, that are mostly carried on in the open air, and by men who are comparatively uneducated." He also considers as an additional factor in the high suicide rates of soldiers, physicians, and chemists the ready access to the means of destruction.

In general, the occupations of educated men show high rates, and, as has already been pointed out, it is precisely among educated men that the individualistic viewpoint has gone farthest. In the case of persons of independent means this is reinforced by the lack of an economic goal which will create an external interest. The only learned profession which has a low suicide rate, the clergy, is the one which is most under the influence of traditional thought. Low economic status is generally characterized by low suicide rates so long as it is fairly stable, but precarious occupations, in which the worker may be at one time in easy enough circumstances to acquire a taste for small luxuries and at another time in want, show high rates. The low rates of most of the lower classes are no doubt due in part to lack of time for introspection.

TABLE XLVI.

Suicides per 100,000 in various male occupations in England and Wales, 1878–1883.

Occupation.	Annual suicides per 100,000 living.	Occupation.	Annual suicides per 100,000 living.
All males	22.2	Tanner, fellmonger, currier, furrier, saddler, harness and leather goods maker	24.9
Soldier	114.9	Miller	23.9
Inn, hotel servant	65.0	Textile factory worker	22.9
Innkeeper, publican, spirit, wine, beer dealer	47.4	Painter, plumber, glazier, locksmith, bellhanger, gas-fitter	22.4
Medical practitioner	47.2	Blacksmith	22.2
Chemist, druggist	44.4	Bookseller, stationer, grocer, draper, coal dealer, tobacconist, ironmonger, general shopkeeper	21.8
Barrister, solicitor	40.8	Carter, carrier, haulier	21.4
Butcher, fishmonger, poulterer, greengrocer, fruiterer	40.7	Carpenter, joiner	21.3
Domestic servant	37.7	Sawyer	20.1
Hairdresser, hatter, glover, umbrella, stick maker	36.4	Metal worker	20.1
Cheesemonger, butterman, milkman	35.3	Policeman	20.1
Commercial traveller, broker agent	34.6	China, earthenware, glass worker	19.3
Cabinet maker, upholsterer, French polisher, carver, gilder, shop fittings maker, undertaker	34.1	Wheelwright, coach, carriage maker	18.0
Commercial and law clerk	32.9	Agricultural, general, road, railway, clay, gravel, sand labourer	17.7
Baker, confectioner	32.8	Mason, bricklayer, builder, tiler, slater, plasterer, whitewasher	17.5
Watchmaker, philosophical instrument maker, jeweller	31.5	Gardener	16.0
Porter, messenger, watchman	31.4	Fisherman	15.7
Coachman, cabman, flyman, stableman, groom	30.3	Quarryman	14.1
Schoolmaster, teacher	29.0	Clergyman, priest, minister	13.9
Farmer, grazier	27.0	Shipwright, shipbuilder	9.6
Printer, bookbinder	26.2	Miner	7.4
Tailor	25.6		
Shoemaker	25.2		

TABLE XLVII.

Suicides per 10,000 males of each occupation and age group in Switzerland, 1889–1900.

20–29 years.		30–39 years.		40–49 years.		50–59 years.	
All occupations.	4	All occupations.	5	All occupations.	7	All occupations.	10
Needleworkers..	1	Creameries and cheese factories	2	Painters.....	3	Railway employees.....	4
Lumbermen....	1	Railway employees....	2	Creameries and cheese factories	3	Teachers.....	5
Silk weavers....	1	Needleworkers..	3	Woodworkers...	3	Machinists.....	6
Teachers.....	2	Lumbermen....	3	Postal and telegraph employees.....	3	Postal and telegraph employees.....	7
Joiners and glaziers.....	2	Millers.....	3	Teachers.....	4	Painters.....	7
Railway employees.....	2	Machinists.....	4	Needleworkers..	4	Farmers and drovers.....	7
Foresters.....	2	Silk weavers....	4	Railway employees.....	4	Draymen and porters.....	8
Bridge and road workers.....	2	Postal and telegraph employees.....	4	Farmers and drovers.....	6	Bakers.....	8
Creameries and cheese factories	2	Foresters.....	4	Lumbermen....	6	Shoemakers....	8
Cotton mill workers.....	3	Cotton mill workers.....	4	Silk weavers....	6	Creameries and cheese factories	8
Carpenters.....	3	Joiners and glaziers.....	4	Foresters.....	6	Public officials..	9
Millers.....	3	Farmers and drovers.....	5	Millers.....	6	Merchants and bankers.....	9
Farmers and drovers.....	3	Tailors.....	5	Public officials..	7	Bridge and road workers.....	10
Machinists.....	3	Locksmiths.....	5	Hardware dealers.....	7	Silk weavers....	10
Bakers.....	3	Painters.....	5	Draymen and porters.....	7	Woodworkers...	11
Postal and telegraph employees.....	3	Teachers.....	5	Masons and builders.....	7	Foresters.....	11
Hardware dealers.....	3	Public officials..	5	Tailors.....	7	Carpenters.....	11
Metal workers..	4	Masons and builders.....	5	Joiners and glaziers.....	7	Cotton mill workers.....	11
Woodworkers...	4	Hotel and café personnel.....	6	Machinists.....	7	Tailors.....	12
Shoemakers....	4	Watchmakers...	6	Cotton mill workers.....	7	Needleworkers..	12

TABLE XLVII (*Continued*).

20–29 years.		30–39 years.		40–49 years.		50–59 years.	
Watchmakers...	4	Butchers.....	6	Shoemakers....	8	Millers.....	12
Locksmiths.....	4	Carpenters.....	6	Gardeners.....	8	Joiners and glaziers.....	13
Masons and builders.....	4	Bridge and road workers.....	6	Merchants and bankers.....	8	Masons and builders.....	13
Draymen and porters.....	5	Merchants and bankers.....	6	Bridge and road workers.....	9	Watchmakers...	13
Hotel and café personnel.....	5	Hardware dealers.....	6	Hotel and café personnel.....	9	Hardware dealers.....	13
Painters.....	5	Bakers.....	6	Metal workers..	9	Metal workers..	15
Tailors.....	5	Metal workers..	6	Bakers.....	9	Lumbermen....	17
Merchants and bankers.....	6	Gardeners.....	7	Carpenters.....	10	Hotel and café personnel.....	17
Butchers.....	6	Woodworkers...	8	Butchers.....	10	Butchers.....	18
Gardeners.....	6	Shoemakers....	8	Watchmakers...	12	Gardeners.....	20
Public officials..	6	Draymen and porters.....	9	Locksmiths.....	15	Locksmiths.....	24

Table XLVII, from the Swiss official publication *Marriages, Naissances, et Décès, 1891–1900*, shows specific rates for males by occupation and age. At each age the occupations are ranged in ascending order of suicide rate. It will be noted that the order of different occupations changes widely with age. Only a few remain throughout life in the same portion of the scale, railway and creamery employees, farmers, and drovers in the lower part, masons and builders, hotel and café personnel, watchmakers, butchers, and gardeners in the upper part. The high rates for gardeners are surprising in view of the low rates for farmers. Many of the occupations which show low suicide rates in early adult life increase rapidly in later years, when their members are becoming superannuated and economic pressure grows greater on them. On the other hand, the rates for merchants and bankers and public officials, which are high in early life, decrease steadily with increase in age.

Finally, Table XLVIII, in which the earlier figures are from Krose, the later from *Marriages*, etc., shows the suicide rates in Switzerland in groups of districts classified according to predominant religious, occupational, and racial character. It will be seen that the Protestant districts show uniformly higher rates than Roman Catholic districts similar in racial and occupational character, that the French

districts are in general higher than the German, and that among the Roman Catholic the rate declines from industrial to mixed and from mixed to agricultural districts. Among the French Protestants on the other hand the rate increases in passing from industrial to agricultural districts.

TABLE XLVIII.

Suicides per 100,000 in Switzerland by religious, occupational, and racial groups of districts.

	1881–1890.		1891–1900.	
	Protestant.	Roman Catholic.	Protestant.	Roman Catholic.
A. Industrial	28.9	20.8	39	23
German	25.7	16.5	36	23
French	37.8	30.9	48	27
B. Mixed	26.6	11.1	35	14
German	22.8	11.6	28	14
French	42.9	15.1	56	14
Italian	....	6.6	..	..
Romansch	15.3	....	..	..
C. Agricultural	26.6	8.1	39	11
German	20.9	7.4	33	11
French	41.4	8.8	59	14
Italian	....	8.2	..	..
Romansch	21.3	8.8	..	..
Whole country	28.0	13.2	..	..

10. *Motive.*

The question of motive for suicide, while interesting, is in a particular case often difficult to determine. The figures on the subject must therefore involve large uncertainties, for which reason some writers on demography refuse to consider statistics on motives of suicide. However, valuable and valid conclusions can often be drawn from material subject to large errors, provided we bear in mind the limitations of the material.

Table XLIX, from v. Mayr (1917, p. 385), the earlier figures being due to Morselli and Krose, gives the percentage distribution of motives of suicide in Prussia at several periods. Of the various causes, mental

TABLE XLIX.

Percentage distribution of motives of suicide in Prussia.

Males.

	1869–1872.	1873–1876.	1883–1890.	1906.	1907.	1908.
Taedium vitae	11.9	12.2	10.4	6.6	6.3	6.2
Physical illness	5.3	6.0	8.3	10.3	10.2	9.8
Nervous diseases	....	....	....	3.3	3.9	3.3
Mental diseases	29.5	22.9	22.2	22.1	22.8	22.4
Passion	2.1	2.6	2.3	2.8	2.6	2.4
Vice	9.9	13.0	11.6	12.1	12.6	12.4
of which Alcoholism	....	....	....	11.6	12.1	11.8
Grief and worry	10.9	11.9	13.8	9.4	10.4	11.9
Remorse, shame	10.6	8.7	8.0	7.3	7.5	7.3
Quarrels	2.4	2.3	2.7	1.6	1.7	2.2
Other and unknown	17.4	20.4	19.7	24.5	22.0	22.1

Females.

Taedium vitae	7.1	8.9	7.5	3.6	4.8	3.3
Physical illness	7.3	6.7	9.2	8.8	8.4	9.2
Nervous diseases	....	....	....	6.5	9.0	7.9
Mental diseases	48.4	43.7	40.9	36.1	38.0	38.3
Passion	4.7	6.2	5.8	6.3	6.9	5.7
Vice	2.2	2.1	2.5	1.5	2.4	1.4
of which Alcoholism	....	....	....	1.3	2.1	1.3
Grief and worry	6.7	6.9	8.1	7.4	7.1	9.1
Remorse, shame	10.9	9.1	8.5	6.9	5.3	5.4
Quarrels	2.8	2.9	2.6	1.8	1.6	1.9
Other and unknown	9.9	12.3	14.9	21.1	17.0	17.8

diseases are responsible for the largest proportion of suicides in both sexes but especially among women. Mental and nervous diseases and passion form a larger proportion of the causes for female suicides than for males, whereas the opposite relation holds true for *taedium vitae*, vice, and grief and worry. *Taedium vitae* and remorse as causes of suicide have declined in both sexes. Either Prussia is becoming a more interesting place to live in and its inhabitants less introspective in their habits of thought, or the Prussian registration officials are becoming more loth to use their imaginations in cases of suicide where the motive is uncertain. That the latter is at least a factor is sug-

gested by the increase in the percentage of suicides with unknown motive. Suicides as a result of physical illness on the other hand have increased. Either the population has become less able to endure physical suffering, or the morbidity of Prussia has not paralleled the decline in the mortality of the country.

TABLE L.

Percentage distribution of motives of suicide in Saxony.

	Males.		Females.	
	1881–1890.	1891–1895.	1881–1890.	1891–1895.
Physical illness	10.4	14.7	11.7	17.7
Domestic troubles	3.1	3.9	3.9	4.6
Loss of property	3.5	4.0	0.4	0.9
Want	7.0	6.4	2.3	2.0
Vice, alcoholism	10.8	8.9	13.1	0.9
Gambling	0.02	....	....	....
Remorse and shame	8.4	9.8	8.0	7.7
Unhappy love	2.2	2.1	5.2	7.2
Melancholia	20.1	19.4	33.1	30.4
Mania	6.4	4.5	1.3	7.9
Religious enthusiasm	0.06	....	0.1	0.1
Chagrin	2.7	1.1	3.8	1.7
Taedium vitae	7.0	6.5	5.0	5.3
Other and unknown	18.3	18.7	12.1	13.6

	1905–1908.	
	Male.	Female.
Mental and nervous diseases	11.3	21.0
Melancholia	19.1	29.7
Physical illness	15.2	14.8
Want	7.7	1.0
Domestic quarrels	3.7	3.2
Fear of punishment	8.7	4.4
Alcoholism	5.9	0.2
Injured honor	0.9	0.9
Taedium vitae	6.6	4.3
Unhappy love	2.5	8.3
Other causes	2.5	2.0
Unknown	15.9	10.2

Table L, from v. Mayr (1917, p. 386), shows similarly the per-

centage distribution of motives of suicide in Saxony for different periods. In the last period the list of motives is changed from that under which the first two periods were tabulated. Here again mental diseases, this time separated into several rubrics, are the most frequent causes of suicide. Of the mental diseases melancholia forms, as we should expect, the greater portion. Melancholia, unhappy love, and chagrin form a larger proportion of the motives for female suicides than for male, while the opposite is true of *taedium vitae*, loss of property, want, and mania. Apparently the mental diseases as a whole (including melancholia) have increased markedly in both sexes, although the change in classification may render the proportions in the different periods incomparable. The trend of physical illness is also upward.

TABLE LI.

Percentage distribution of motives of suicide in Bavaria.

	1881–1890.	1891–1901.
Taedium vitae	8.1	3.7
Physical illness	6.7	8.8
Mental diseases	32.5	38.8
Passions	3.4	4.0
Vice	6.7	5.6
Sorrow	0.2	0.3
Misfortune	10.7	7.6
Remorse and shame	9.0	9.3
Quarrels	3.7	3.4
Other motives	2.2	1.5
Unknown motives	16.8	17.1

Table LI, from v. Mayr (1917, p. 386), gives for Bavaria the percentage distribution of motives of suicide but without distinction of sex. Here again mental diseases are by far the most frequent of the motives of suicide, and are increasing in importance as is also physical illness. *Taedium vitae*, vice, and misfortune play a part of diminishing importance.

Table LII, quoted by v. Mayr from Krose, gives the percentage distribution of motives of suicide in France and Italy by sex. Here again mental diseases play the most important part, although among the Italian males grief and worry nearly equal them. Mental diseases, passion, and quarrels are more important motives among women than among men in both countries, while vice, grief and worry, and remorse and shame claim a larger proportion of victims among the males. In France the proportion due to physical illness is high

in both sexes as compared with both Germany and Italy, while in both France and Italy the proportion due to quarrels is three to five times that of the more phlegmatic Germans. Suicides due to passion are also a larger proportion of the whole in Italy than in the other countries.

TABLE LII.

Percentage distribution of motives of suicide in France and Italy, 1878–1887.

	France.		Italy.	
	Male.	Female.	Male.	Female.
Physical illness	15.0	15.2	7.3	6.2
Mental diseases	30.0	40.0	25.3	44.2
Taedium vitae	3.0	3.2	....	....
Vice	13.2	5.7	1.2	....
Passion	1.7	5.8	4.6	8.0
Quarrels	12.0	16.2	9.2	12.0
Grief and worry	12.8	6.7	24.5	8.6
Remorse and shame	4.8	2.3	4.5	2.7
Unknown motives	7.5	4.9	23.4	18.3

TABLE LIII.

Percentage distribution of motives for suicide in Switzerland, 1891–1900.

	Male.	Female.
Taedium vitae	6	6
Physical illness	10	10
Passion	9	17
Vices and misconduct	8	1
Sorrow and misery	42	30
Remorse and shame	12	16
Quarrels	9	14
Other motives	4	6

Table LIII, from *Marriages*, etc., differs from the previous tables in not having mental diseases tabulated under a separate heading. They are probably included in the main under sorrow and misery, although the propriety of such a classification is doubtful. Quarrels claim a proportion of suicides comparable to those of France and Italy, while passion accounts for a proportion twice that of Italy and still higher than France or Germany.

We find then that in western Europe, mental disease is the most frequent motive of suicide, and that both mental and physical diseases are increasing in importance as motives.

TABLE LIV.

Percentage distribution of motives of suicide in Serbia, 1902–1906.

	Male.	Female.	Both sexes.
Mental disease	10.68	13.46	11.60
Poverty	5.82	1.92	4.52
Chronic illness	21.36	32.69	25.16
Crime	2.91	....	1.94
Sorrow	0.97	3.85	1.94
Debt	3.88	....	2.58
Unhappy marriage	....	3.85	1.29
Intoxication	3.88	1.92	3.23
Other causes	18.46	13.46	16.77
Unknown causes	32.04	28.85	30.92

Table LIV, from v. Mayr (1917, p. 386), gives similar figures for Serbia. Here the outstanding features are the small proportion attributed to mental disease, and the large proportion attributed to illness, the latter being here the most frequent motive. Mental disease, illness, sorrow, and unhappy marriage are more common motives of suicide among females than males, while the opposite is true of poverty, crime, debt, and intoxication.

TABLE LV.

Percentage distribution of motives of suicide in Bombay, 1895–1907.

	Male.	Female.
Tired of life through sickness	33.3	31.7
Domestic quarrels	4.1	33.1
Insanity	13.3	14.7
Debt and pecuniary wants	8.9	1.6
Dissipated and drunken habits	8.5	0.5
Despondency	6.4	3.1
Grief	3.1	8.7
Want of employment	2.6	0.3
Accusation of theft	2.5	1.3
Scolded by parents	3.6	0.5
Prisoner in jail	0.3	....
Fear of removal to plague hospital	1.6	2.4
Loss of money	2.6	0.3
Love and jealousy	1.8	0.3
Quarrel with employer or friends	1.3	....
Misappropriation of money	1.3	....
Shame	0.4	0.5
Unknown	4.4	1.0

Table LV, calculated from data in Patel, is based on 685 male suicides and 381 female. It resembles the distribution for Serbia, rather than those for western Europe, in the large proportion of suicides due to illness and the small proportion due to insanity. Domestic quarrels are the commonest of all motives among women, the proportion being twice as great as in France, and ten times that of the German women.

TABLE LVI.

Percentage distribution of motives of suicide in Japan.

	1897.			1906.		
	Male.	Female.	Both sexes.	Male.	Female.	Both sexes.
Mental disease	49.7	51.8	50.5	47.5	49.8	48.4
Misfortune and want	15.8	8.3	12.8	13.1	7.9	11.0
Illness	13.1	13.8	13.4	16.2	18.3	16.9
Love	3.7	8.5	5.6	2.8	6.2	4.2
Remorse and shame	4.3	2.8	3.7	4.1	1.9	3.1
Family quarrels	1.9	4.9	3.1	1.9	4.9	3.1
Fear for the future	0.8	1.0	0.9	0.8	0.8	0.8
Loss of property and debt	1.7	0.4	1.2	1.9	0.3	1.3
Other motives	3.7	4.8	4.1	5.2	6.0	5.5
Unknown motives	5.3	3.7	4.7	6.5	4.6	5.7

Table LVI, from v. Mayr, the figures for 1897 being due originally to Schnapper-Arndt, shows the distribution of motives of suicide in Japan, which resembles those already quoted for France, Germany, and Italy much more than those of Serbia and Bombay. Mental disease claims a high proportion, in fact about half of all suicides, but the females show no such excess over the males as in most countries. Suicides due to illness are on about the same level as in France and Saxony, and as in Europe are increasing in importance. Misfortune and want, remorse and shame, and loss of property claim a larger proportion of males than females, while the reverse is true of family quarrels and love.

Table LVII, from v. Mayr (1917, p. 390), shows the effect of urban and rural conditions on motives of suicide in Denmark. Suicides due to physical illness, economic pressure, and domestic cares in both sexes, and to alcoholism in the female account for a larger proportion of the

total in the city while suicides from melancholia are relatively more frequent in the country.

TABLE LVII.

Percentage distribution of motives of suicide in urban and rural districts of Denmark, 1896–1900.

	Male.			Female.		
	Capital.	Other cities.	Country.	Capital.	Other cities.	Country.
Physical illness	14.5	10.8	11.2	15.6	10.8	13.3
Melancholia and *taedium vitae*	19.4	19.1	26.1	34.4	44.6	43.4
Delirium	3.6	4.3	3.9	4.9	2.3	4.7
Alcoholism	16.0	17.6	15.4	5.2	3.3	3.7
Unhappy love, jealousy	3.5	2.7	3.6	7.5	5.2	5.6
Economic pressure	21.2	19.4	11.3	5.8	7.5	4.1
Remorse and shame	5.5	7.2	4.6	4.5	4.7	5.7
Domestic cares	4.7	2.8	3.5	6.8	4.2	2.1
Other and unknown	11.6	16.1	20.4	15.3	17.4	17.4
	100.0	100.0	100.0	100.0	100.0	100.0

TABLE LVIII.

Percentage distribution of motives of suicide in different age classes in Denmark, 1896–1905.

	15–25	25–35	35–45	45–55	55–65	65–75	75 and over
	Males.						
Physical illness	6.3	10.0	7.7	11.0	14.0	20.8	19.2
Melancholia and *taedium vitae*	19.4	23.2	20.0	20.0	24.4	27.2	33.9
Delirium	2.0	5.5	5.7	4.1	2.7	3.1	3.3
Alcoholism	2.0	9.8	21.6	22.8	18.7	13.5	7.9
Unhappy love, jealousy	22.2	7.3	1.5	0.5	0.3	....	....
Economic pressure	6.8	14.7	19.2	19.8	19.2	11.5	5.9
Remorse and shame	13.8	7.5	4.2	4.8	3.7	3.0	....
Domestic cares	0.8	4.0	5.8	4.2	3.4	3.1	3.8
Other and unknown	26.7	18.0	14.3	12.8	13.6	17.8	26.0
	100	100	100	100	100	100	100

Females.

Physical illness	6.2	10.4	8.7	13.5	16.6	22.5	13.3
Melancholia and *taedium vitae*	16.3	35.2	47.5	47.9	47.9	48.2	44.4
Delirium	1.7	1.6	4.4	6.2	6.2	5.8	5.6
Alcoholism	....	3.2	3.8	5.7	5.7	4.2	2.2
Unhappy love, jealousy	28.1	12.8	1.2	....	....	0.5	....
Economic pressure	3.9	6.4	6.9	3.3	3.3	4.7	5.6
Remorse and shame	15.7	6.4	4.4	3.8	3.8	....	....
Domestic cares	2.2	7.2	6.2	3.3	3.3	3.1	....
Other and unknown	25.9	16.8	16.9	13.2	13.2	11.0	28.9
	100	100	100	100	100	100	100

Table LVIII, from v. Mayr, shows the effect of age upon the distribution of motives of suicide in Denmark. In both sexes the proportion of suicides due to physical illness increases with advancing age, with, however, a depression about age 40 and a decline after age 75. Melancholia in the male increases after age 55, while in the female it increases up to age 35. Delirium reaches a maximum in males about age 40, in females about age 55, after which it declines. Alcoholism shows a similar course. Unhappy love is most potent before age 25, after which it rapidly sinks into insignificance. Economic pressure reaches its maximum in the male about age 50, after which it declines notably. In the female it reaches a maximum about age 40 but after falling rises again in old age. Remorse and shame as causes of suicide decline steadily in importance with age but not so rapidly as unhappy love. Domestic cares reach their maximum about age 40 in the male and about age 30 in the female.

Table LIX, quoted by v. Mayr from Guttstadt, gives a similar distribution for Prussia. *Taedium vitae* shows in both sexes an increase with advancing age in the proportion of suicides for which it is responsible. Those due to physical illness increase in the male to the end of life, but in the female reach a maximum about age 55. Suicides due to mental diseases increase until about age 35 and then remain fairly level until old age, when they decrease. Passional suicides reach their maximum about age 23 and then decline rapidly. Suicides due to vice do not reach their maximum proportion until about age 55. Misfortune shows its greatest effect around age 45 in the male, but in the female the maximum is somewhat earlier with another rise in old age. Remorse and shame, and quarrels are most potent in adolescence. In its main features the table agrees with the distribution previously given for Denmark.

TABLE LIX.

Percentage distribution of motives of suicide in different Age classes in Prussia, 1869–1872.

	5–10.	10–15.	15–20.	20–25.	25–30.	30–40.	40–50.	50–60.	60–70.	70–80.	80 and over.	Unknown.	All ages.
						Males.							
Taedium vitae	10.0	1.8	3.6	3.5	8.5	7.3	10.0	14.9	21.7	29.1	36.5	8.1	11.8
Physical illness	....	....	1.7	3.2	5.7	4.0	5.6	6.2	7.0	9.0	12.1	2.7	5.3
Mental diseases	10.0	11.8	22.4	21.2	24.5	32.9	32.7	31.8	34.2	30.0	29.9	12.8	29.5
Passions	....	4.5	4.2	6.5	5.7	3.2	0.8	0.4	0.3	....	....	2.7	2.1
Vice	....	0.9	3.0	3.6	6.8	10.2	13.8	15.0	9.0	6.0	4.0	6.2	9.8
Sorrow	....	0.9	0.2	0.6	0.8	0.6	0.2	0.5	0.3	0.4	....	....	0.5
Misfortune	....	0.9	4.2	5.4	9.8	12.0	13.8	12.3	9.9	9.7	2.7	7.7	10.4
Remorse and shame	20.0	30.9	22.4	24.2	12.5	10.8	8.1	6.3	5.6	3.9	1.3	3.2	10.7
Quarrels	....	6.3	7.4	4.8	2.6	2.0	1.8	1.7	1.2	0.6	....	0.3	2.4
Unknown motives	60.0	42.0	30.9	27.0	23.0	17.0	13.2	10.9	10.8	11.3	13.5	56.3	17.5
	100	100	100	100	100	100	100	100	100	100	100	100	100

TABLE LIX (*Continued*).

	5–10.	10–15.	15–20.	20–25.	25–30.	30–40.	40–50.	50–60.	60–70.	70–80.	80 and over.	Unknown.	All ages.
						Females.							
Taedium vitae	....	....	3.5	4.1	2.9	4.3	5.7	7.6	11.9	23.9	41.3	5.0	7.2
Physical illness	....	5.0	2.1	3.3	5.0	7.3	8.4	12.5	8.2	8.5	3.4	5.0	7.2
Mental diseases	....	10.0	26.3	26.1	43.4	54.6	57.0	56.0	63.6	52.1	37.4	45.0	48.4
Passions	....	....	10.6	16.4	9.5	3.2	1.2	0.2	....	....	....	5.0	4.7
Vice	....	....	1.7	0.8	....	1.6	3.2	4.8	2.6	1.7	....	5.0	2.3
Sorrow	....	....	0.4	0.4	....	1.6	1.6	0.5	....	....	....	....	0.8
Misfortune	....	10.0	2.4	4.1	5.8	8.0	7.9	6.5	4.8	4.0	10.3	....	6.0
Remorse and shame	50.0	40.0	27.7	24.2	17.0	7.6	6.6	5.6	1.1	1.7	....	5.0	10.8
Quarrels	....	5.0	11.6	4.8	2.9	3.5	0.7	0.8	0.3	0.8	....	....	2.8
Unknown motives	50.0	30.0	13.8	27.0	13.5	8.3	7.7	5.5	7.5	7.3	7.6	30.0	9.8
	100	100	100	100	100	100	100	100	100	100	100	100	100

TABLE LX.

Relative number out of a total of 1,000 suicides dying by hanging, drowning, shooting, or cutting.

Country.	Mode of suicide.				
	Period.	Hanging.	Drowning.	Shooting.	Cutting.
Australia	1907–1910	165	104	289	151
Austria	1887–1891	444	259	173	...
Bavaria	1887–1890	536	203	208	...
Belgium	1889–1893	492	249	155	19
Denmark	1896–1900	749	130	54	13
England	1889–1893	277	227	93	182
France	1887–1891	435	260	125	24
Italy	1889–1893	167	232	254	41
Norway	1888–1890	656	172	78	47
Prussia	1891–1900	586	184	129	23
Saxony	1891–1900	598	196	117	20
Sweden	1889–1893	495	154	140	56
Württemberg	1890–1899	589	158	152	27
Switzerland	1889–1893	433	235	190	53

II. Method.

Table LX, quoted by Knibbs from Krose, shows for mode of suicide in most countries the following order of preference: hanging, drowning, shooting, cutting. Germany and Scandinavia show the greatest fondness for hanging; France, Austria, Belgium, and Italy for drowning; Australia and Italy for shooting; Australia and England for cutting. The disinclination of the inhabitants of cold climates towards drowning is explicable on a purely climatic basis, but the high proportion of suicides by cutting in England and Australia seems to be a racial characteristic.

Table LXI, calculated from the mortality statistics of the Census Bureau, shows that in the United States suicides by firearms are most frequent among males, and suicides by poison among females. In general, the differences between white and colored are less than those between the sexes.

Table LXII, calculated from material in the Swedish official publications, shows hanging to be the favorite method of suicide for both sexes in Sweden, drowning being the next in popularity among females and before 1880 among males. Firearms and hanging are

TABLE LXI.

Percentage distribution of methods of suicide in the United States registration area by color and sex, 1916–1919.

Method of suicide.	White.		Colored.	
	Male.	Female.	Male.	Female.
Poison	13.0	30.6	8.9	35.8
Asphyxia	11.6	21.4	5.9	8.2
Hanging or strangulation	17.7	13.1	11.7	8.2
Drowning	5.0	10.3	10.5	8.5
Firearms	40.2	14.1	44.1	22.7
Cutting or piercing instruments	8.4	3.4	11.7	6.4
Jumping from high places	2.2	4.5	3.9	3.9
Crushing	1.0	0.8	1.8	1.4
Other methods	0.8	1.8	1.5	5.0
Number of cases	28,520	9,800	879	282

TABLE LXII.

Percentage distribution of methods of suicide in Sweden by sex.

Male.

	1861–1870	1871–1880	1881–1890	1891–1900	1901–1910
Firearms	10.7	12.4	15.2	16.8	21.6
Cutting and stabbing	9.5	9.1	8.2	5.6	6.2
Drowning	18.9	17.8	15.3	13.8	12.6
Hanging	50.2	53.4	55.1	57.6	54.0
Poison	8.2	6.1	4.9	4.4	2.8
Other and unknown	2.6	1.2	1.4	1.8	2.8
Cases	2,586	2,968	3,899	5,089	6,575

Females.

Firearms	....	0.5	0.5	0.7	2.9
Cutting and stabbing	8.8	9.3	5.5	7.2	5.7
Drowning	34.1	31.9	33.5	30.2	32.1
Hanging	37.6	41.1	48.9	45.1	45.9
Poison	17.8	16.2	10.6	14.3	9.0
Other and unknown	1.7	1.1	1.1	2.5	4.4
Cases	692	841	935	1,227	1,462

more common among men than women, while drowning and poison are more common among women than men. The proportion of suicides by firearms and hanging has on the whole increased, while cutting and stabbing, drowning, and poison have decreased in popularity.

TABLE LXIII.

Percentage distribution of methods of suicide in Switzerland by sex.

	Male.		Female.	
	1891–1900.	1881–1890.	1891–1900.	1881–1890.
Hanging	46	46	26	26
Firearms	24	22	3	2
Drowning	18	20	47	49
Cutting and stabbing	5	5	4	5
Poison	3	3	8	8
Throwing self under train	2	2	2	2
Throwing self from height	1	1	6	4
Asphyxia by CO	1	1	3	3
Other and unknown	0	0	1	1

In Table LXIII, from *Marriages*, etc., hanging is the most common mode of suicide among males, but drowning is the favorite among females. Hanging and firearms are more characteristic of the male; drowning, poison, throwing oneself from a height, and asphyxia of the females. Ogle found similar sexual preferences in England and Wales.

TABLE LXIV.

Percentage distribution of mode of suicide by sex.

Country.	Period.	Hanging.		Drowning.		Shooting.		Poisoning.		Cutting.	
		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Russia	1904–1908	57.3	39.6	12.2	31.2	19.4	3.2	5.2	16.6	.....	
Japan	1902–1907	62.3	44.4	18.4	43.0	2.4	0.3	2.7	2.5	3.9	2.7
Serbia	1902–1906	34.1	61.9	9.8	7.1	41.5	23.9	7.3	.9	4.9	5.3
Australia	1907–1910	17.1	13.5	8.2	20.8	33.6	6.4	18.1	45.5	16.5	8.5

In Table LXIV, from Knibbs, shooting, cutting, and hanging are more characteristic of the males; drowning and poisoning of the females. Serbia forms an exception in regard to these sexual preferences. There hanging is more characteristic of the female and poisoning of the male.

TABLE LXV.

Percentage distribution of methods of suicide in Denmark, 1896–1905, by sex and age.

	Males aged:				Females aged:			
	15–35.	35–45.	55–75.	75 and over.	15–35.	35–45.	55–75.	75 and over.–
Hanging	63.0	81.5	86.8	87.5	32.0	63.4	67.9	58.9
Drowning	10.1	7.4	6.6	7.5	37.5	21.7	24.6	32.2
Firearms	17.9	5.3	3.2	2.1	6.8	0.5	0.3	....
Poison	5.0	2.3	1.8	0.8	17.5	7.1	2.0	1.1
Other methods	4.2	3.5	1.6	2.1	6.2	7.3	5.2	7.8

In Table XLV, from v. Mayr (1917, p. 379), firearms and poison are most used by those under age 35, hanging increases with age, while drowning first decreases and then increases.

In Table LXVI, from *Marriages*, etc., suicides by firearms show a maximum in the age period 20–29. Poison and throwing oneself under train are also more characteristic of the younger suicides, while cutting and stabbing and throwing oneself from a height are more common in old age.

For England and Wales Ogle found "that, as age advances, there is an increasing comparative distaste for the use of the gun, of poison, and of drowning, and an increasing preferential selection of the knife and cord."

Table LXVII, from v. Mayr (1917, p. 375), the figures for 1845–1856 being due to Wagner, shows the effect of urban and rural conditions on the methods of suicide adopted by each sex. Suicides by hanging form an increasing proportion of the whole as we pass from the metropolis to the country, although the change is much smaller in 1896–1905 than in 1845–1856. Suicides by firearms, cutting and precipitation, and poison form a smaller proportion of the whole in the country than in the city, while suicides by drowning in the earlier period are most frequent in Copenhagen among males and in the

TABLE LXVI.

Percentage distribution of methods of suicide in Switzerland, 1891–1900, by sex and age.

	Under 15.	15–19.	20–29.	30–39.	40–49.	50–59.	60–69.	70–79.	80 and over.
Males.									
Hanging	63	38	28	40	45	56	58	47	39
Firearms	15	33	44	28	26	15	11	14	7
Drowning	7	16	16	18	19	18	19	27	37
Cutting and stabbing	..	1	3	5	5	4	6	6	17
Poison	4	5	4	4	2	3	2	1	..
Throwing self under train	11	6	3	2	1	1	1	1	..
Throwing self from height	..	1	1	2	1	1	2	3	..
Asphyxiation	..	..	1	1	1	2	1	1	..
Other or unknown	..	..	0	0	0	0	0	..	..
Females.									
Drowning	83	58	50	48	42	44	45	48	43
Hanging	17	10	10	25	32	36	34	33	14
Poison	..	19	15	13	6	3	3	2	..
Throwing self from height	..	4	3	4	8	7	6	9	22
Cutting and stabbing	..	..	5	2	5	5	6	4	14
Asphyxiation	..	1	6	2	2	4	3	2	..
Firearms	..	5	7	3	2	0	1	..	..
Throwing self under train	..	3	3	2	2	1	1	..	..
Other or unknown	..	..	1	1	1	0	1	2	7

smaller cities among females, whereas in the later period they are least frequent in Copenhagen for both sexes.

TABLE LXVII.

Percentage distribution of methods of suicide in Denmark by urban and rural districts.

		Drowning.		Hanging.		Firearms.	
		Male.	Female.	Male.	Female.	Male.	Female.
Copenhagen	1845–1856	23.0	41.7	56.4	31.4	11.8	...
	1896–1905	6.5	13.6	72.2	54.9	12.2	5.2
Other cities	1845–1856	17.6	51.7	69.1	39.7	8.1	0.7
	1896–1905	9.7	24.9	75.9	55.4	8.7	2.8
Country	1845–1856	12.4	36.7	79.5	57.7	5.0	...
	1896–1905	8.0	34.8	84.8	57.6	3.7	0.7

		Cutting and Precipitation.		Poison.	
		Male.	Female.	Male.	Female.
Copenhagen	1845–1856	6.4	12.0	2.4	14.9
	1896–1905	5.1	11.4	3.5	11.4
Other cities	1845–1856	3.7	4.3	1.5	3.6
	1896–1905	2.1	5.1	3.0	10.8
Country	1845–1856	2.6	5.0	0.5	0.6
	1896–1905	1.6	2.4	1.8	4.9

Table LXVIII, from *Marriages*, etc., shows the preferences of different occupations in Switzerland as to manner of suicide. The upper middle class, represented by merchants, bankers, and public officials, shows the greatest disinclination to hanging and a strong preference as compared with most occupations for firearms. The fondness of butchers for suicide by shooting is also noteworthy. None of these cases can well be explained on the ground that these occupations have more ready access to firearms than others. The high proportion of suicides from drowning among bridge and road workers is explicable on the ready access hypothesis.

Table LXIX, from Ogle, shows the proportion of methods of suicide employed by males of different occupations in England. Here

TABLE LXVIII.

Percentage distribution of methods of suicide chosen by various occupations in Switzerland, 1891–1900.

	Hanging.	Firearms.	Drowning.
Carpenters	61	16	12
Farmers and drovers	59	17	17
Cotton mill workers	48	21	21
Watchmakers	45	23	19
Masons and builders	45	23	20
Bridge and road workers	45	13	34
Shoemakers	43	21	18
Tailors	40	16	24
Joiners	36	30	24
Butchers	32	48	11
Railway employees	29	34	19
Ironworkers	27	37	20
Merchants and bankers	25	41	20
Public officials	16	59	22

TABLE LXIX.

Methods of suicide employed by males of different occupations, per 100 suicides of all kinds, 1878–1883.

Occupation.	Gun shot.	Cut or stab.	Poison.	Drowning.	Hanging.	Jump from height.	Railway.	Otherwise or unstated.
Medical practitioner, student, assistant	9	12	60	2	9	3	..	5
Chemist, druggist	..	..	86	5	7	2	..	.
Photographer	..	10	85	..	..	5	..	.
Soldier	35	17	13	4	17	5	4	5
Butcher	5	31	7	15	35	2	3	2
Shoemaker	3	22	8	19	41	2	1	4
Miner	1	19	1	24	43	7	4	1
Sailor	16	13	5	17	41	2	4	2
Railway servant	6	23	6	21	21	.	17	6
Clergyman, lawyer, independent gentleman	29	20	9	15	14	4	2	7
Grocer, draper	7	14	11	18	42	2	3	3
Farmer, grazier	14	18	4	13	46	.	1	4
Agricultural laborer	1	18	2	19	55	.	2	3
Innkeeper, publican, inn servant, butler, cellarman	13	23	9	16	35	1	1	2
All males	7	21	8	15	42	2	2	3

physicians, druggists, and photographers show a high proportion of suicides from poison, butchers from cutting, soldiers from shooting. These are all instances where the mode of suicide is one which is readily accessible to that occupation, and in which the suicide rate for the occupation is high, and therefore suggest that the high rates in these occupations may be due to the ease with which the means of self-destruction may be found. Miners and shoemakers, whose suicide rates are low, show no great tendency to use the methods of suicide which are most readily accessible to them, viz., jumping from a height and stabbing. Butchers in England do not show the preference for shooting which we have seen in Switzerland, but clergymen, lawyers, and gentlemen agree with the Swiss upper middle class in a preference for shooting and a distaste for hanging.

II. Correlation of suicide with climatic and other factors.

We may now turn to an investigation by another method of the relation between suicide and certain factors of the physical and social environment as well as of the inherent constitution of the population. The method to be used in this portion of the study is that of partial or net correlation. For a detailed description of the method and derivation of the formulae by which partial coefficients of correlation are calculated the reader is referred to the papers of Pearson and Yule.* For the benefit of those unacquainted with the method a short explanation may be useful.

Two characters, whether in the same individual or in a connected pair of individuals, are said to be correlated when the means of the quantitative values of one character corresponding to a particular value of the other character are functions of the value of the second character. If the means are independent of the value of the second character, the two characters are said to be uncorrelated. In other words, if

$$\bar{y}_{x_i} = \frac{1}{n_{x_i}} \sum y_{x_i}$$

* Pearson, K.

1896. Regression, Heredity, and Panmixia. Phil. Trans. Roy. Soc., Series A, CLXXXVII, 253.

Yule, G. U.

1897. On the Significance of Bravais' Formulae for Regression, etc., in the Case of Skew Correlation. Proc. Roy. Soc., LX, 477.

———.

1907. On the Theory of Correlation for any Number of Variables Treated by a New System of Notation. Proc. Roy. Soc., Series A, LXXIX, 182.

be the mean of the array of y's associated with the value x_i of the character x, the two characters are correlated if $\bar{y}_{x_i}$ changes in value for different values of x_i, but are uncorrelated if y_{x_i} remains unchanged for different values of x_i. Any constant which determines the functional relation $\bar{y}_{x_i} = f(x_i)$ measures the correlation between x and y.

Let $\eta_1, \eta_2, \cdots \eta_n$ be the deviations from their respective means of a complex of n characters, the values of which are determined by a large number of independent contributory causes, following the normal law of distribution, and with small variations as compared with their absolute values. Let the number of causes be m, which will in general be much larger than n, and let their deviations from their means be $\epsilon_1, \epsilon_2, \cdots \epsilon_m$. Then

$$\begin{aligned} \eta_1 &= \psi_1(\epsilon_1, \epsilon_2, \cdots \epsilon_m), \\ \eta_2 &= \psi_2(\epsilon_1, \epsilon_2, \cdots \epsilon_m), \\ &\cdots\cdots\cdots, \\ \eta_n &= \psi_n(\epsilon_1, \epsilon_2, \cdots \epsilon_m). \end{aligned} \tag{i}$$

Certain of the ϵ's will appear only in certain of the ψ's, i.e., certain of the causes will not be common to all of the characters. Furthermore, since $m > n$, the ϵ's will not be fully determined for a given complex of η's. The mean of each character being associated with the mean value of each cause, and the variations of the ϵ's being small in comparison with their absolute values, we have

$$\begin{aligned} \eta_1 &= \alpha_{11}\epsilon_1 + \alpha_{12}\epsilon_2 + \cdots + \alpha_{1m}\epsilon_m, \\ \eta_2 &= \alpha_{21}\epsilon_1 + \alpha_{22}\epsilon_2 + \cdots + \alpha_{2m}\epsilon_m, \\ &\cdots\cdots\cdots, \\ \eta_n &= \alpha_{n1}\epsilon_1 + \alpha_{n2}\epsilon_2 + \cdots + \alpha_{nm}\epsilon_m, \end{aligned} \tag{ii}$$

in which any of the α's may be zero.

Now since the ϵ's are independent of each other, the probability that we have a conjunction of contributory causes lying between ϵ_1 and $\epsilon_1 + \delta\epsilon_1$, ϵ_2 and $\epsilon_2 + \delta\epsilon_2$, $\cdots \epsilon_m$ and $\epsilon_m + \delta\epsilon_m$ is

$$P = Ce^{-\frac{1}{2}\left(\frac{\epsilon_1^2}{\kappa_1^2} + \frac{\epsilon_2^2}{\kappa_2^2} + \cdots + \frac{\epsilon_m^2}{\kappa_m^2}\right)} \times \delta\epsilon_1\delta\epsilon_2\cdots\delta\epsilon_m, \tag{iii}$$

where $\kappa_1, \kappa_2, \cdots \kappa_m$ are the standard deviations of $\epsilon_1, \epsilon_2, \cdots \epsilon_m$ respectively and C is a constant.

From the equations (ii) we can express any n, say the first n, of the ϵ's in terms of the η's and the remaining ϵ's. Substituting in equation (iii) we have the probability of occurrence of a complex of characters lying between η_1 and $\eta_1 + \delta\eta_1$, η_2 and $\eta_2 + \delta\eta_2$, $\cdots \eta_n$ and $\eta_n + \delta\eta_n$,

together with a series of contributory causes lying between ϵ_{n+1} and

$\epsilon_{n+1} + \delta\epsilon_{n+1}$, ϵ_{n+2} and $\epsilon_{n+2} + \delta\epsilon_{n+2}$, $\cdots$ ϵ_m and $\epsilon_m + \delta\epsilon_m$.

$$P' = C' e^{-\frac{1}{2}\phi^2} \delta\eta_1 \delta\eta_2 \cdots \delta\eta_n \delta\epsilon_{n+1} \cdots \delta\epsilon_m, \qquad \text{(iv)}$$

where C' is a function of C and ϕ^2 consists of three parts:

(i) A quadratic function of the η's, $\sum_1^n (C_{ii}\eta_i^2) + 2\sum_1^n (C_{ik}\eta_i\eta_k)$.

(ii) A quadratic function of the ϵ's, $\sum_{n+1}^m (C_{ii}'\epsilon_i^2) + 2\sum_{n+1}^m (C'_{ik}\epsilon_i\epsilon_k)$.

(iii) A series of functions of the type

$$\begin{aligned}
&\epsilon_{n+1}(b_{1,\ n+1}\eta_1 + b_{2,\ n+1}\eta_2 + \cdots + b_{n,\ n+1}\eta_n),\\
&\epsilon_{n+2}(b_{1,\ n+2}\eta_1 + b_{2,\ n+2}\eta_2 + \cdots + b_{n,\ n+2}\eta_n),\\
&\cdots\cdots\cdots\cdots\cdots\cdots\cdots,\\
&\epsilon_m(b_{1,\ m}\eta_1 + b_{2,\ m}\eta_2 + \cdots + b_{n,\ m}\eta_n),
\end{aligned}$$

where some of the b's may be zero.

Integrating P' for the values from $-\infty$ to $+\infty$ of the contributory causes ϵ_{n+1}, ϵ_{n+2} $\cdots$ ϵ_m, we have the whole probability of a complex of characters between η_1 and $\eta_1 + \delta\eta_1$, η_2 and $\eta_2 + \delta\eta_2 \cdots \eta_n$ and $\eta_n + \delta\eta_n$.

$$\begin{aligned}
P &= \int_{-\infty}^{+\infty} - \int_{-\infty}^{+\infty} - \cdots \int_{-\infty}^{+\infty} - C' e^{-\frac{1}{2}\phi^2} \delta\eta_1 \delta\eta_2 \cdots \delta\eta_n \delta\epsilon_{n+1} \cdots \delta\epsilon_m \qquad \text{(v)}\\
&= C e^{-\frac{1}{2}\chi^2} \delta\eta_1 \delta\eta_2 \cdots \delta\eta_n,
\end{aligned}$$

where

$$\chi^2 = \sum_1^n (a_{ii}\eta_i^2) + 2\sum_1^n (a_{ik}\eta_i\eta_k).$$

This is the normal correlation surface, first deduced by Bravais. For n characters it demands for its representation an $n + 1$ dimensional space.

For the special case $n = 2$, equation (v) may be written in the form

$$z = \frac{N}{2\pi\sigma_1\sigma_2} \frac{1}{\sqrt{1 - r_2}} e^{-\frac{1}{2}\left\{ \frac{x^2}{\sigma_1^2(1-r^2)} - \frac{2xyr}{\sigma_1\sigma_2(1-r^2)} + \frac{y^2}{\sigma_2^2(1-r^2)} \right\}}, \qquad \text{(vi)}$$

where N is the number of observations, x and y are the deviations of the characters from their respective means, and σ_1 and σ_2 are their standard deviations. It will be easily seen that for a constant value of x the distribution of y is a normal curve and vice versa, also that the contours of equal frequency form a series of concentric and similar ellipses.

The value of r which when substituted in equation (vi) will make the probability of a given set of pairs of characters a maximum is

$$r = \frac{\Sigma(xy)}{N\sigma_1\sigma_2}. \qquad \text{(vii)}$$

This function is the coefficient of correlation, usually adopted as the measure of the correlation between two variables.

A coefficient of correlation measures the degree to which two variables are associated, taking the value + 1 when a deviation of one variable from its mean is always associated with a proportional deviation of the other in the same direction, decreasing as the intensity of the association decreases until for complete independence of the two variables it takes the value 0, and again increasing in numerical value but with a negative sign for increasing intensity of association where deviations of one variable in one direction are coupled with deviations of the other variable in the opposite direction. Thus the absolute magnitude of a coefficient of correlation measures the intensity of the association of two variables, while its sign indicates whether as one variable changes the average values of the other variable change in the same or in opposite directions. The possible range of values is from + 1 to − 1.

The coefficient of correlation may also be regarded from another viewpoint. In the original definition of correlation x and y were said to be correlated if $\bar{y}_{x_i}$, the mean of values of y associated with x_i, changed with x_i. Now in the normal correlation surface the values of $\bar{y}_{x_i}$ lie on a straight line, the regression line of y on x. Similarly the values of $\bar{x}_{y_i}$ lie on the regression line of x on y. In actual practice the values of $\bar{y}_{x_i}$ and $\bar{x}_{y_i}$ will not be exactly collinear and the determination of the regression lines becomes the problem of fitting a straight line by least squares to the means of the arrays, which may be reduced to the fitting of a straight line to the values of one variable associated with given values of the other. Let the equation of the line be

$$x = a_1 + b_1 y. \tag{vii}$$

Our problem then is to determine a_1 and b_1 in such a manner as to make $\Sigma[x - (a_1 + b_1 y)]^2$ a minimum.

Differentiating with respect to a_1 we have

$$\frac{\partial}{\partial a_1} \Sigma[x - (a_1 + b_1 y)]^2 = -2\Sigma[x - (a_1 + b_1 y)] = 0, \tag{viii}$$

whence $a_1 = 0$, since $\Sigma(x) = \Sigma(y) = 0$, i.e., the regression line passes through the intersection of the means of the two characters.

Similarly

$$\frac{\partial}{\partial b_1} \Sigma(x - b_1 y)^2 = -2\Sigma y(x - b_1 y) = 0, \tag{ix}$$

whence

$$b_1 = \frac{\Sigma(xy)}{\Sigma(y^2)} = r\frac{\sigma_1}{\sigma_2},$$

and in the same way

$$b_2 = r\frac{\sigma_2}{\sigma_1}.$$

Whatever the form of the correlation surface,

$$x = r\frac{\sigma_1}{\sigma_2}y$$

is the line which will give the minimum mean square error of estimate of x for a determinate value of y. From (vii) it is evident that the numerical value of the coefficient of correlation may be calculated by determining (1) the mean of the x's, (2) the deviation of each x from the mean x, (3) the mean of the y's, and (4) the deviation of each y from the mean y. By squaring each x deviation, summing the squares, dividing by N, the number of observations, and extracting the square root we obtain σ_1, the standard deviation of x. In a precisely similar manner σ_2, the standard deviation of y, is calculated. $\Sigma(xy)$ is obtained by multiplying together corresponding x and y deviations and summing the products, remembering to take account of sign. With these quantities known r may at once be found. The process is straightforward but, when N is large, very laborious. In such cases it is better to work from a grouped correlation table. The process is analogous to that of calculating means and standard deviations from a grouped frequency distribution.

The measurements on which a correlation coefficient is based are in general those of individuals which differ in other characters besides those measured. Thus one might measure the head length and head breadth of each person in a community and calculate the coefficient of correlation, which would measure the intensity of association of the two variables. But among those we had measured would be those of all heights and a considerable part of the observed association would be due simply to the fact that tall people tend to have large heads, i.e., not to a true correlation of head length with head breadth, but to the correlation of height on the one hand with head length and on the other with head breadth. How could we find the net correlation of head length with head breadth free from the disturbing effect of varying height? Obviously by grouping our population so that the persons in each group were of the same height, and then calculating

the coefficient of correlation between head length and head breadth for each group separately. It is however not necessary to go through the labor of determining the net coefficient of correlation for each group separately, as we can obtain an average value of the coefficients of correlation for the various groups which measures the association of head length and head breadth for constant height.

To deal with these cases the conception of the regression equation is extended from two to n variables, so that

$$x_1 = b_{12\cdot 34\cdots n}x_2 + b_{13\cdot 24\cdots n}x_3 + \cdots + b_{1n\cdot 23\cdots n-1}x_n \qquad (x)$$

is the equation by which is estimated the mean value of the array of x_1's corresponding to given values of x_2, $x_3 \cdots x_n$. The first subscript in the suffix of each regression coefficient gives the dependent variable, the second the variable of which the given regression is the coefficient, and the subscripts after the period indicate the other independent variables entering into the equation. The subscripts before and after the period are distinguished as primary and secondary. A coefficient with p secondary subscripts is termed a regression of the pth order.

If for any particular set of values x_1, $x_2 \cdots x_n$ the values $x_2 \cdots x_n$ are substituted in equation (x), the difference between the value of x_1 so obtained and the observed value, i.e., the error of estimate involved in estimating x_1 from equation (x), may be denoted by $x_{1\cdot 23\cdots n}$, so that

$$x_{1\cdot 23\cdots n} = x_1 - b_{12\cdot 34\cdots n}x_2 - b_{13\cdot 24\cdots n}x_3 - \cdots - b_{1n\cdot 23\cdots n-1}x_n. \qquad (xi)$$

Such a deviation with p secondary subscripts is called a deviation of the pth order.

The values of the regression coefficients are to be determined as in the case of two variables by the condition that $\Sigma(x_{1\cdot 23\cdots n}{}^2)$ shall be a minimum. Differentiating with respect to each regression coefficient in turn, we obtain the normal equations

$$\Sigma(x_2 \cdot x_{1\cdot 23\cdots n}) = \Sigma(x_3 \cdot x_{1\cdot 23\cdots n}) = \cdots = \Sigma(x_n \cdot x_{1\cdot 23\cdots n}) = 0, \qquad (xii)$$

i.e., the product-sum of any deviation of order zero with any deviation of higher order is zero, provided the subscripts of the former occur among the secondary subscripts of the latter.

Now

$$\Sigma(x_{1\cdot 34\cdots n}x_{2\cdot 34\cdots n}) = \Sigma(x_{1\cdot 34\cdots n})(x_2 - b_{23\cdot 4\cdots n}x_3 - \cdots - b_{2n\cdot 3\cdots n-1}x_n).$$

But all these products except the first are zero by equation (xii). Therefore

$$\Sigma(x_{1\cdot 34\cdots n}x_{2\cdot 34\cdots n}) = \Sigma(x_{1\cdot 34\cdots n}x_2).$$

Similarly

$$\Sigma(x_{1\cdot 34\cdots n}x_{2\cdot 34\cdots n-1}) = \Sigma(x_{1\cdot 34\cdots n}x_2)$$

and in general

$$\Sigma(x_{1\cdot 34\cdots n}x_{2\cdot 34\cdots n}) = \Sigma(x_{1\cdot 34\cdots n}x_{2\cdot 34\cdots n-1}) = \cdots = \Sigma(x_{1\cdot 34\cdots n}x_2), \quad \text{(xiii)}$$

i.e., the product-sum of any two deviations of the same order, with the same secondary subscripts, is unaltered by omitting any or all of the secondary subscripts of either but not of both, and conversely, the product-sum of any deviation with a deviation of higher order where all the secondary subscripts of the former are included among the secondary subscripts of the latter is unaltered by adding to the secondary subscripts of the former any or all of the additional secondary subscripts of the latter.

It follows from (xii) and (xiii) that the product-sum of any two deviations is zero if all the subscripts of the one are included among the secondary subscripts of the other, for

$$\Sigma(x_{1\cdot 34\cdots n}x_{3\cdot 4\cdots n}) = \Sigma(x_{1\cdot 34\cdots n}x_{3\cdot 4\cdots n-1}) = \cdots = \Sigma(x_{1\cdot 34\cdots n}x_3) = 0. \quad \text{(xiv)}$$

As the standard deviation is defined by $N\sigma^2 = \Sigma(x^2)$, so we may define a standard deviation of the pth order by

$$N\sigma_{1\cdot 23\cdots n}{}^2 = \Sigma(x_{1\cdot 23\cdots n}{}^2) \quad \text{(xv)}$$

and the relation $r = (b_1b_2)^{1/2}$ may be extended to define a correlation of the pth order

$$r_{12\cdot 34\cdots n} = (b_{12\cdot 34\cdots n}b_{21\cdot 34\cdots n})^{1/2}. \quad \text{(xvi)}$$

It will be noticed that whereas the order of the primary subscripts is material in the case of the regression coefficients, it is immaterial in the case of the correlation coefficients.

From (xiii) and (xiv)

$$\begin{aligned} 0 &= \Sigma(x_{2\cdot 34\cdots n}x_{1\cdot 234\cdots n}) \\ &= \Sigma(x_{2\cdot 34\cdots n})(x_1 - b_{12\cdot 34\cdots n}x_2 - \text{terms in } x_3 \text{ to } x_n) \\ &= \Sigma(x_1x_{2\cdot 34\cdots n}) - b_{12\cdot 34\cdots n}\Sigma(x_2x_{2\cdot 34\cdots n}) \\ &= \Sigma(x_{1\cdot 34\cdots n}x_{2\cdot 34\cdots n}) - b_{12\cdot 34\cdots n}\Sigma(x_{2\cdot 34\cdots n}{}^2). \end{aligned}$$

Therefore

$$b_{12\cdot 34\cdots n} = \frac{\Sigma(x_{1\cdot 34\cdots n}x_{2\cdot 34\cdots n})}{\Sigma(x_{2\cdot 34\cdots n}{}^2)}.$$

That is, a regression coefficient of the pth order is the same function

of deviations of the pth order that a regression coefficient of zero order is of deviations of zero order. We may therefore regard $r_{12\cdot34\cdots n}$ as the correlation between $x_{1\cdot34\cdots n}x_{2\cdot34\cdots n}$ and may write

$$b_{12\cdot34\cdots n} = r_{12\cdot34\cdots n}\frac{\sigma_{1\cdot34\cdots n}}{\sigma_{2\cdot34\cdots n}}. \qquad \text{(xviii)}$$

From (xii) and (xiii)

$$\begin{aligned}\Sigma(x_{1\cdot23\cdots n}{}^2) &= \Sigma(x_{1\cdot23\cdots n-1}x_{1\cdot23\cdots n})\\ &= \Sigma(x_{1\cdot23\cdots n-1})(x_1 - b_{1n\cdot23\cdots n-1}x_n - \text{terms in } x_2 \text{ to } x_{n-1})\\ &= \Sigma(x_{1\cdot23\cdots n-1}{}^2) - b_{1n\cdot23\cdots n-1}\Sigma(x_{1\cdot23\cdots n-1}x_{n\cdot23\cdots n-1}).\\ \sigma_{1\cdot23\cdots n}{}^2 &= \sigma_{1\cdot23\cdots n-1}{}^2(1 - b_{1n\cdot23\cdots n-1}b_{n1\cdot23\cdots n-1})\\ &= \sigma_{1\cdot23\cdots n-1}{}^2(1 - r_{1n\cdot23\cdots n-1}{}^2). \qquad \text{(xix)}\end{aligned}$$

This expresses a standard deviation of the pth order in terms of a standard deviation and a correlation of the $p-1$th order.

In the derivation of (xix) we might have eliminated any other subscript instead of n Therefore, in general,

$$\begin{aligned}\sigma_{1\cdot23\cdots n}{}^2 &= \sigma_{1\cdot34\cdots n}{}^2(1 - r_{12\cdot34\cdots n}{}^2) = \sigma_{1\cdot24\cdots n}{}^2(1 - r_{13\cdot24\cdots n}{}^2)\\ &= \cdots = \sigma_{1\cdot23\cdots n-1}{}^2(1 - r_{1n\cdot23\cdots n-1}{}^2). \qquad \text{(xx)}\end{aligned}$$

By successive application of this formula we have

$$\begin{aligned}\sigma_{1\cdot23\cdots n}{}^2 &= \sigma_1{}^2(1 - r_{12}{}^2)(1 - r_{13\cdot2}{}^2)(1 - r_{14\cdot23}{}^2)\cdots(1 - r_{1n\cdot23\cdots n-1}{}^2)\\ &= \sigma_1{}^2(1 - r_{13}{}^2)(1 - r_{12\cdot3}{}^2)(1 - r_{14\cdot23}{}^2)\cdots(1 - r_{1n\cdot23\cdots n-1}{}^2)\\ &= \cdots \qquad \text{(xxi)}\\ &= \sigma_1{}^2(1 - r_{1n}{}^2)(1 - r_{1(n-1)\cdot n}{}^2)(1 - r_{1(n-2)\cdot n(n-1)}{}^2)\\ &\qquad \cdots(1 - r_{12\cdot34\cdots n}{}^2).\end{aligned}$$

Thus standard deviations of higher orders may be obtained from those of the zero order. Furthermore, by using say both the first and the last of the above forms in calculating $\sigma_{1\cdot23\cdots n}{}^2$ we obtain a complete check on the arithmetic.

$$\begin{aligned}\Sigma(x_{1\cdot34\cdots n}x_{2\cdot34\cdots n}) &= \Sigma(x_{1\cdot34\cdots n-1}x_{2\cdot34\cdots n})\\ &= \Sigma(x_{1\cdot34\cdots n-1})(x_2 - b_{2n\cdot34\cdots n-1}x_n\\ &\qquad - \text{terms in } x_3 \text{ to } x_{n-1})\\ &= \Sigma(x_{1\cdot34\cdots n-1}x_{2\cdot34\cdots n-1})\\ &\qquad - b_{2n\cdot34\cdots n-1}\Sigma(x_{1\cdot34\cdots n-1}x_{n\cdot34\cdots n-1}).\end{aligned}$$

Therefore, dividing by N

$$\begin{aligned}\sigma_{1\cdot34\cdots n}\sigma_{2\cdot34\cdots n}r_{12\cdot34\cdots n} &= \sigma_{1\cdot34\cdots n-1}\sigma_{2\cdot34\cdots n-1}r_{12\cdot34\cdots n-1}\\ &\qquad - b_{2n\cdot34\cdots n-1}\sigma_{1\cdot34\cdots n-1}\sigma_{n\cdot34\cdots n-1}r_{1n\cdot34\cdots n-1}.\end{aligned}$$

Substituting the values of $b_{2n\cdot 34\cdots n-1}$, $\sigma_{1\cdot 34\cdots n}$ and $\sigma_{2\cdot 34\cdots n}$ from (xviii) and (xx),

$$r_{12\cdot 34\cdots n} = \frac{\left\{\begin{array}{l} \sigma_{1\cdot 34\cdots n-1}\sigma_{2\cdot 34\cdots n-1}r_{12\cdot 34\cdots n-1} \\ - r_{2n\cdot 34\cdots n-1}\dfrac{\sigma_{2\cdot 34\cdots n-1}}{\sigma_{n\cdot 34\cdots n-1}}\sigma_{1\cdot 34\cdots n-1}\sigma_{n\cdot 34\cdots n-1}r_{1n\cdot 34\cdots n-1} \end{array}\right\}}{\sigma_{1\cdot 34\cdots n-1}\sigma_{2\cdot 34\cdots n-1}(1 - r_{1n\cdot 34\cdots n-1}{}^2)^{\frac{1}{2}}(1 - r_{2n\cdot 34\cdots n-1}{}^2)^{\frac{1}{2}}}$$

$$= \frac{r_{12\cdot 34\cdots n-1} - r_{1n\cdot 34\cdots n-1}r_{2n\cdot 34\cdots n-1}}{(1 - r_{1n\cdot 34\cdots n-1}{}^2)^{\frac{1}{2}}(1 - r_{2n\cdot 34\cdots n-1}{}^2)^{\frac{1}{2}}}. \qquad \text{(xxii)}$$

By this formula we may obtain the correlations of any order from those of the next lower order and therefore by successive applications may build up the higher order correlations from those of the zero order. A correlation of the second or higher order may be obtained in more than one way, thus checking the computation.

From what has been said as to the meaning of a partial correlation coefficient, it may be seen that the method combines certain of the advantages of the experimental and statistical methods. In an experiment our object is to study the relation between two factors when other factors are held constant. Thus the physicist will study the relation of the pressure and volume of a given mass of gas under constant conditions of temperature, and the geneticist studying the inheritance of a physiological character rears his animals under the same environmental conditions. In most investigations having man as their subject we cannot control extraneous factors to any significant degree. A method, therefore, which enables us to determine the correlation of two factors when other factors are held constant from their correlation when the other factors vary, makes it possible to obtain the kind of answer for the sake of which experiments are performed from material which is not susceptible to experiment. This is the merit of the method of partial correlation. It has, however, the disadvantage of being extremely laborious.

The material used in this study consists of those cities in the United States of 25,000 inhabitants or over at the Census of 1910 which were included in the United States registration area in the years 1909, 1910, and 1911. From these were deducted all cities containing a state insane asylum, in order that abnormalities due to the concentration of the insane in these cities might not be included in the material. Certain cities for which not all the desired information could be obtained were also excluded. After these deductions had been made there remained 174 cities on which the correlations are based. The values of the variables for each city are given in an appendix.

The variables, the correlations of which were treated, were as follows:

1. The absolute number of suicides in each city in the three years 1909, 1910, and 1911. The suicides for three years were taken rather than those for a single year in order to minimize the influence of the abnormalities which might affect one year. The data were obtained from the mortality statistics of the Census Bureau.

2*a*. The mean percentage of sunshine in each city in 1909, 1910, and 1911, from the reports of the Weather Bureau.

2*b*. The altitude of each city, from the dictionary of altitudes published by the Coast and Geodetic Survey, or in some cases from the topographical maps of the Geological Survey.

2*c*. The mean annual precipitation in each city in 1909, 1910, and 1911, from the reports of the Weather Bureau.

2*d*. The mean temperature in each city in 1909, 1910, and 1911, from the reports of the Weather Bureau. In 2*a*, 2*c*, and 2*d* in cases where no records were available for a city, the observations for the nearest place for which they were recorded were used. General climatic conditions are similar over large areas of country, while the differences caused by variations of local topography are of minor importance. It should be remembered also that these latter vary somewhat even within the limits of a city of large area, so that the error introduced by using observations for a neighboring town is in general of the same order of magnitude as that involved in assuming that the climatic conditions which the official recording instruments measure are those in which the greater part of the inhabitants live.

3. Total population of each city at the Thirteenth Census (1910).

4. The age index of each city as defined by Pearl.* This is a function of the age distribution of a city or other geographical unit defined as

$$\phi = (M - M_P)\Sigma\left\{\frac{^2\Delta}{P}\right\},$$

where Δ is the deviation for each of the six age groups, 0–4, 5–14, 15–24, 25–44, 45–64, 65 and over, of the percentage of the actual population of the city from the percentage in the same age group in some standard population, the latter percentage being denoted in the formula by P. In this paper the actual populations are those for

* Pearl, R.
1920. On a Single Numerical Index of the Age Distribution of a Population. Proc. Nat. Acad. Sci., VI, 427–431.

1910, while the standard population is the L_x of Glover's* life table. This is the age distribution of the population which would result in a community in which the specific death rates were the same as in the United States registration area but in which there was neither immigration nor emigration and only so many births as would replace the losses caused by death. Under these conditions not only the total population but the age distribution would become stabilized. M = the mean age of the living population in the particular city; M_P = the mean age of the standard population—in this case the stationary population of Glover's life table before mentioned.

It will be noticed that the expression consists of two factors. The latter factor, the summation, measures the magnitude of the deviation in the age distribution of the particular city from that of the standard population, being in fact the χ^2 of Pearson's test of goodness of fit, while the difference between the mean ages of the actual and of the standard populations gives the direction in which the age distribution of the city deviates from the standard, i.e., whether by an excess of the higher or of the lower ages.

As most cities show a larger number of births than deaths and moreover the greatest influx to the cities is of those in early adult life, it follows that in general there will be a larger proportion of the lower ages in the cities than in the standard population and consequently a lower mean age in the former. Therefore the values ϕ will practically always be negative for cities. A low *numerical* value of the age index means therefore a high proportion of old people in the population and *vice versa*.

5. The number of males in each city at the Thirteenth Census.

6. The land area of each city on July 1, 1918, from Financial Statistics of Cities, 1919, Table 1. The area in 1918 was taken because for a number of the cities it could not be obtained at a date nearer 1910. The area of a city, however, is an attribute that changes slowly, so that there is little inaccuracy in the difference between the dates at which this and the other variables were taken.

7. Absolute number of deaths from all causes except suicide in each city in 1909, 1910, and 1911, from the mortality statistics of the Census Bureau. A three-year period was chosen for the reason given under suicide.

8. Number of persons employed in manufacturing industries in each city in 1910 from the Thirteenth Census.

* Glover, J. W.
1916. United States Life Tables, 1910. Bureau of the Census.

9. Number of negroes in each city from the Thirteenth Census.

Throughout the paper the variables will be represented by the same numbers as subscripts which are here used as headings. Thus $r_{12_3 \cdot 34}$ will be the symbol for "the coefficient of correlation between number of suicides and per cent. of sunshine when population and age index are constant," and so for other cases.

By dealing with absolute numbers as variables and introducing population as a factor which is held constant in all the partial correlations considered we avoid spurious correlation due to the use of rates. For instance, if we correlated suicide rate with proportion of males in the population, the correlation would be between two sets of ratios, each of which had the population of the respective cities as denominator. A portion of the correlation so obtained would be spurious, i.e., due, not to a real correlation between the masculinity of the population and the prevalence of suicide, but merely to the fact that corresponding members of the two groups of ratios have the same denominator. By correlating absolute number of suicides with absolute number of males, we obtain in the partial correlation of the two for constant population a measure of the association between masculinity of the population and prevalence of suicide which does not involve the purely formal correlation due to the use of ratios of which the denominators are the same. In the same way the partial correlations of the land area of the cities with other variables for constant population measure the association of density with other factors; the partial correlations of deaths from all causes except suicide with other variables for constant population measure the association of the mortality of the cities with other factors; the partial correlations of number of persons employed in manufacturing industries and number of negroes with other variables for constant population measure respectively the association of the industrialization of a city and of the proportion of negroes in its population with other factors.

The number of negroes is taken as representing the most important and fundamental racial differentiation for American cities. As those cities which have a large negro population have only a small foreign born element, holding the number of negroes constant also removes to a large extent the disturbing influence of varying proportions of foreign born.

The use of deaths from all causes *except suicide* avoids any spurious correlation which might exist between suicide and deaths from all causes owing to the former being included in the latter. The mor-

tality of a population is probably under present conditions the most satisfactory measure we have of the state of its health. If morbidity records were available of the same accuracy and extent as the present mortality records, they would undoubtedly be preferable as a measure of the state of health of a community. The mortality also measures the biological fitness of a population, its ability to survive.

Table LXX gives the correlations of suicide with certain climatic factors when the various factors of social environment and constitution of the population are constant. It may be objected that altitude is not a climatic factor. This is strictly true yet the influence of altitude on the human organism is through differences in the pressure of the atmosphere and other climatic factors. Altitude, therefore, is the measure of a complex of climatic factors.

Throughout this and the succeeding tables Yule's notation for partial correlation coefficients is used. In each line in the column headed *subscript* the two figures to the left of the point (the primary subscripts) represent the variables between which the correlation exists, while the figures to the right of the point (the secondary subscripts) represent the variables which are held constant. The numerical value of the corresponding coefficient of correlation with its probable error is given in the column headed Coefficient. Thus $+ .043 \pm .051$ are the numerical value and probable error of the coefficient of correlation between suicide and per cent. of sunshine for constant population and age index. It follows from the earlier discussion that conclusions should be drawn only from those correlations in which population is constant, i.e., in which 3 occurs among the secondary subscripts. The zero-order correlations which of course do not satisfy this condition are included in the table because the other correlations are based on them but will not be cited in the discussion. The most important correlations are those with the greatest number of factors constant.

In no case is any of the partial correlations of suicide with mean per cent. of sunshine as much as three times its probable error; it cannot therefore be concluded that the *mean* per cent. of sunshine in a locality has any influence on the frequency of suicide, although as we have seen in the first part of the paper Dexter found an influence of the daily variations in sunshine in the same locality upon suicide. The correlations of altitude with suicide are also not significant.

The partial correlations of mean precipitation with suicide range from $r_{12c \cdot 379} = - .268 \pm .047$ to $r_{12c \cdot 345678} = - .141 \pm .050$, the former being over five times and the latter just under three times its probable

TABLE LXX.

Correlations of suicide with climatic factors.

Per cent. of sunshine.				Altitude.			
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
12*a*	+.069±.051	12*a*.3567	+.103±.051	12*b*	−.053±.051	12*b*.3567	+.087±.051
12*a*.3	+.051±.051	12*a*.3568	+.051±.051	12*b*.3	+.100±.051	12*b*.3568	+.087±.051
12*a*.34	+.043±.051	12*a*.3569	+.082±.051	12*b*.34	+.100±.051	12*b*.3569	+.099±.051
12*a*.35	+.116±.050	12*a*.3578	+.092±.051	12*b*.35	+.105±.051	12*b*.3578	+.081±.051
12*a*.36	+.019±.051	12*a*.3579	+.117±.050	12*b*.36	+.089±.051	12*b*.3579	+.098±.051
12*a*.37	+.068±.051	12*a*.3589	+.066±.051	12*b*.37	+.088±.051	12*b*.3589	+.098±.051
12*a*.38	+.026±.051	12*a*.3678	+.019±.051	12*b*.38	+.093±.051	12*b*.3678	+.076±.051
12*a*.39	+.049±.051	12*a*.3679	+.033±.051	12*b*.39	+.101±.051	12*b*.3679	+.081±.051
12*a*.345	+.108±.051	12*a*.3689	+.010±.051	12*b*.345	+.106±.051	12*b*.3689	+.081±.051
12*a*.346	+.013±.051	12*a*.3789	+.040±.051	12*b*.346	+.090±.051	12*b*.3789	+.085±.051
12*a*.347	+.060±.051	12*a*.34567	+.097±.051	12*b*.347	+.088±.051	12*b*.34567	+.087±.051
12*a*.348	+.018±.051	12*a*.34568	+.043±.051	12*b*.348	+.094±.051	12*b*.34568	+.087±.051
12*a*.349	+.040±.051	12*a*.34569	+.073±.051	12*b*.349	+.101±.051	12*b*.34569	+.101±.051
12*a*.356	+.085±.051	12*a*.34578	+.083±.051	12*b*.356	+.096±.051	12*b*.34578	+.082±.051
12*a*.357	+.136±.050	12*a*.34579	+.106±.051	12*b*.357	+.094±.051	12*b*.34579	+.099±.051
12*a*.358	+.072±.051	12*a*.34589	+.055±.051	12*b*.358	+.093±.051	12*b*.34589	+.099±.051
12*a*.359	+.104±.051	12*a*.34678	+.013±.051	12*b*.359	+.112±.050	12*b*.34678	+.077±.051

TABLE LXX. (*Continued.*)

Per cent. of sunshine.				Altitude.			
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
12*a*.367	+.035±.051	12*a*.34679	+.025±.051	12*b*.367	+.080±.051	12*b*.34679	+.081±.051
12*a*.368	+.003±.051	12*a*.34689	+.003±.051	12*b*.368	+.086±.051	12*b*.34689	+.082±.051
12*a*.369	+.027±.051	12*a*.34789	+.031±.051	12*b*.369	+.086±.051	12*b*.34789	+.086±.051
12*a*.378	+.044±.051	12*a*.35678	+.069±.051	12*b*.378	+.082±.051	12*b*.35678	+.077±.051
12*a*.379	+.056±.051	12*a*.35679	+.096±.051	12*b*.379	+.090±.051	12*b*.35679	+.091±.051
12*a*.389	+.027±.051	12*a*.35689	+.050±.051	12*b*.389	+.093±.051	12*b*.35689	+.088±.051
12*a*.3456	+.079±.051	12*a*.35789	+.085±.051	12*b*.3456	+.097±.051	12*b*.35789	+.087±.051
12*a*.3457	+.127±.050	12*a*.36789	+.019±.051	12*b*.3457	+.094±.051	12*b*.36789	+.077±.051
12*a*.3458	+.063±.051	12*a*.345678	+.061±.051	12*b*.3458	+.093±.051	12*b*.345678	+.077±.051
12*a*.3459	+.093±.051	12*a*.345679	+.087±.051	12*b*.3459	+.114±.050	12*b*.345679	+.092±.051
12*a*.3467	+.028±.051	12*a*.345689	+.041±.051	12*b*.3467	+.080±.051	12*b*.345689	+.090±.051
12*a*.3468	−.003±.051	12*a*.345789	+.074±.051	12*b*.3468	+.086±.051	12*b*.345789	+.088±.051
12*a*.3469	+.019±.051	12*a*.346789	+.012±.051	12*b*.3469	+.087±.051	12*b*.346789	+.078±.051
12*a*.3478	+.037±.051	12*a*.356789	+.067±.051	12*b*.3478	+.082±.051	12*b*.356789	+.081±.051
12*a*.3479	+.046±.051	12*a*.3456789	+.059±.051	12*b*.3479	+.090±.051	12*b*.3456789	+.083±.051
12*a*.3489	+.018±.051	.....	.....	12*b*.3489	+.094±.051	.....	.....

TABLE LXX (*Continued*).

Precipitation.				Mean temperature.			
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
12*c*	−.009±.051	12*c*.3567	−.167±.050	12*d*	+.070±.051	12*d*.3567	+.149±.050
12*c*.3	−.248±.048	12*c*.3568	−.179±.049	12*d*.3	+.079±.051	12*d*.3568	+.063±.051
12*c*.34	−.234±.048	12*c*.3569	−.208±.049	12*d*.34	+.087±.051	12*d*.3569	+.104±.051
12*c*.35	−.214±.049	12*c*.3578	−.188±.049	12*d*.35	+.148±.050	12*d*.3578	+.146±.050
12*c*.36	−.212±.049	12*c*.3579	−.253±.048	12*d*.36	+.032±.051	12*d*.3579	+.130±.050
12*c*.37	−.231±.048	12*c*.3589	−.236±.048	12*d*.37	+.122±.050	12*d*.3589	+.084±.051
12*c*.38	−.246±.048	12*c*.3678	−.198±.049	12*d*.38	+.051±.051	12*d*.3678	+.052±.051
12*c*.39	−.268±.047	12*c*.3679	−.218±.049	12*d*.39	+.087±.051	12*d*.3679	+.067±.051
12*c*.345	−.191±.049	12*c*.3689	−.209±.049	12*d*.345	+.163±.050	12*d*.3689	+.048±.051
12*c*.346	−.201±.049	12*c*.3789	−.262±.048	12*d*.346	+.040±.051	12*d*.3789	+.073±.051
12*c*.347	−.216±.049	12*c*.34567	−.145±.050	12*d*.347	+.132±.050	12*d*.34567	+.167±.050
12*c*.348	−.232±.048	12*c*.34568	−.158±.050	12*d*.348	+.060±.051	12*d*.34568	+.079±.051
12*c*.349	−.254±.048	12*c*.34569	−.191±.049	12*d*.349	+.092±.051	12*d*.34569	+.114±.050
12*c*.356	−.183±.049	12*c*.34578	−.163±.050	12*d*.356	+.104±.051	12*d*.34578	+.164±.050
12*c*.357	−.195±.049	12*c*.34579	−.230±.048	12*d*.357	+.197±.049	12*d*.34579	+.142±.050
12*c*.358	−.206±.049	12*c*.34589	−.215±.049	12*d*.358	+.096±.051	12*d*.34589	+.095±.051
12*c*.359	−.253±.048	12*c*.34678	−.186±.049	12*d*.359	+.125±.050	12*d*.34678	+.063±.051

TABLE LXX (*Continued*).

Precipitation.				Mean temperature.			
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
12*c*.367	−.199±.049	12*c*.34679	−.207±.049	12*d*.367	+.069±.051	12*d*.34679	+.073±.051
12*c*.368	−.212±.049	12*c*.34689	−.198±.049	12*d*.368	+.014±.051	12*d*.34689	+.054±.051
12*c*.369	−.214±.049	12*c*.34789	−.248±.048	12*d*.369	+.064±.051	12*d*.34789	+.081±.051
12*c*.378	−.229±.048	12*c*.35678	−.163±.050	12*d*.378	+.096±.051	12*d*.35678	+.108±.051
12*c*.379	−.268±.047	12*c*.35679	−.216±.049	12*d*.379	+.088±.051	12*d*.35679	+.111±.051
12*c*.389	−.260±.048	12*c*.35689	−.196±.049	12*d*.389	+.065±.051	12*d*.35689	+.069±.051
12*c*.3456	−.162±.050	12*c*.35789	−.239±.048	12*d*.3456	+.120±.050	12*d*.35789	+.096±.051
12*c*.3457	−.171±.050	12*c*.36789	−.214±.049	12*d*.3457	+.214±.049	12*d*.36789	+.054±.051
12*c*.3458	−.183±.049	12*c*.345678	−.141±.050	12*d*.3458	+.111±.051	12*d*.345678	+.127±.050
12*c*.3459	−.232±.048	12*c*.345679	−.197±.049	12*d*.3459	+.135±.050	12*d*.345679	+.124±.050
12*c*.3467	−.186±.049	12*c*.345689	−.178±.050	12*d*.3467	+.079±.051	12*d*.345689	+.080±.051
12*c*.3468	−.200±.049	12*c*.345789	−.216±.049	12*d*.3468	+.023±.051	12*d*.345789	+.109±.051
12*c*.3469	−.203±.049	12*c*.346789	−.204±.049	12*d*.3469	+.069±.051	12*d*.346789	+.061±.051
12*c*.3478	−.214±.049	12*c*.356789	−.205±.049	12*d*.3478	+.107±.051	12*d*.356789	+.081±.051
12*c*.3479	−.253±.048	12*c*.3456789	−.186±.049	12*d*.3479	+.095±.051	12*d*.3456789	+.094±.051
12*c*.3489	−.247±.048	.....	.....	12*d*.3489	+.072±.051	.....	.....

error. The partial correlation of the seventh order in which all the demographic factors are held constant and their disturbing influence removed is $r_{12c \cdot 3456789} = - .186 + .049$, being 3.8 times its probable error. The odds against such a deviation from zero correlation being due to random sampling are 95 to 1; it is therefore highly probable that there is a real though small negative association between mean precipitation and suicide, i.e., that apart from any relation of the two to the other factors considered, cities with a low precipitation are on the average more disposed to suicide than those with a high precipitation. This accords with Dexter's observation that suicide was excessive for dry days. It should be remembered that this does not necessarily imply that the lowered precipitation is the *cause* of the increased liability to suicide.

The partial correlation of the seventh order between mean temperature and suicide is less than twice its probable error; it might quite well be therefore merely an effect of random sampling where no real association existed.

Table LXXI gives the various partial correlations of suicide with the non-climatic factors. The seventh order correlation of suicide with age index is 3.2 times its probable error; the odds are therefore 31 to 1 against this being a chance deviation from independence of the two variables. It may be noted that those partial correlations in which number of males is included among the secondary subscripts are uniformly larger than those in which it does not occur, i.e., the correlation between suicide and age index is partially obscured in the latter case by the effect of the correlation of each with number of males.

The correlations between suicide and number of males are in every case more than eight times the probable error. It is therefore certain that there is a real correlation between these two variables, a correlation which is but little smaller than that between stature of father and son. The much higher incidence of suicide among males than among females which we have seen to exist in occidental countries accords well with this high correlation.

The correlation between suicide and area, or as we may also regard it, the correlation between suicide and density of population, is diminished by increasing the number of secondary subscripts, so that while $r_{16 \cdot 3} = + .266 \pm .048$, a certainly significant though not large correlation, $r_{16 \cdot 345789} = + .165 \pm .050$. The odds that this is not merely a sample of a population with no real correlation are 37 to 1. If the association is real densely populated, cities tend to have a low suicide rate.

TABLE LXXI.

Correlations of suicide with non-climatic factors.

Age index.		Number of males.	
Subscript.	Coefficient.	Subscript.	Coefficient.
14	−.040±.051	15	+.974±.003
14.3	+.113±.050	15.3	+.379±.044
14.35	+.157±.050	15.34	+.392±.043
14.36	+.098±.051	15.36	+.363±.044
14.37	+.115±.050	15.37	+.379±.044
14.38	+.111±.051	15.38	+.406±.043
14.39	+.114±.050	15.39	+.385±.044
14.356	+.142±.050	15.346	+.376±.044
14.357	+.159±.050	15.347	+.393±.043
14.358	+.159±.050	15.348	+.419±.042
14.359	+.163±.050	15.349	+.400±.043
14.367	+.100±.051	15.367	+.364±.044
14.368	+.097±.051	15.368	+.385±.044
14.369	+.095±.051	15.369	+.362±.044
14.378	+.113±.050	15.378	+.406±.043
14.379	+.122±.050	15.379	+.405±.043
14.389	+.111±.051	15.389	+.408±.043
14.3567	+.144±.050	15.3467	+.377±.044
14.3568	+.144±.050	15.3468	+.398±.043
14.3569	+.145±.050	15.3469	+.377±.044
14.3578	+.161±.050	15.3478	+.420±.042
14.3579	+.179±.049	15.3479	+.423±.042
14.3589	+.162±.050	15.3489	+.422±.042
14.3678	+.099±.051	15.3678	+.386±.044
14.3679	+.102±.051	15.3679	+.379±.044
14.3689	+.094±.051	15.3689	+.382±.044
14.3789	+.120±.050	15.3789	+.421±.042
14.35678	+.147±.050	15.34678	+.399±.043
14.35679	+.160±.050	15.34679	+.396±.043
14.35689	+.145±.050	15.34689	+.396±.043
14.35789	+.176±.050	15.34789	+.438±.041
14.36789	+.100±.051	15.36789	+.394±.043
14.356789	+.159±.050	15.346789	+.411±.042

TABLE LXXI (*Continued*).

Area of town.		Deaths from all causes except suicide.	
Subscript.	Coefficient.	Subscript.	Coefficient.
16	+.512±.038	17	+.962±.004
16.3	+.266±.048	17.3	−.111±.051
16.34	+.260±.048	17.34	−.113±.050
16.35	+.242±.048	17.35	−.114±.050
16.37	+.260±.048	17.36	−.094±.051
16.38	+.257±.048	17.38	−.110±.051
16.39	+.268±.047	17.39	−.144±.050
16.345	+.232±.048	17.345	−.117±.050
16.347	+.254±.048	17.346	−.096±.051
16.348	+.252±.048	17.348	−.112±.050
16.349	+.262±.048	17.349	−.151±.050
16.357	+.235±.048	17.356	−.099±.051
16.358	+.219±.049	17.358	−.113±.050
16.359	+.231±.048	17.359	−.197±.049
16.378	+.251±.048	17.368	−.094±.051
16.379	+.244±.048	17.369	−.088±.051
16.389	+.262±.048	17.389	−.131±.050
16.3457	+.226±.049	17.3456	−.103±.051
16.3458	+.209±.049	17.3458	−.116±.050
16.3459	+.219±.049	17.3459	−.210±.049
16.3478	+.245±.048	17.3468	−.096±.051
16.3479	+.235±.048	17.3469	−.095±.051
16.3489	+.255±.048	17.3489	−.138±.050
16.3578	+.213±.049	17.3568	−.100±.051
16.3579	+.192±.049	17.3569	−.149±.050
16.3589	+.214±.049	17.3589	−.175±.050
16.3789	+.241±.048	17.3689	−.079±.051
16.34578	+.203±.049	17.34568	−.103±.051
16.34579	+.175±.050	17.34569	−.163±.050
16.34589	+.202±.049	17.34589	−.188±.049
16.34789	+.233±.048	17.34689	−.086±.051
16.35789	+.182±.049	17.35689	−.132±.050
16.345789	+.165±.050	17.345689	−.146±.050

TABLE LXXI (*Continued*).

Number employed in manufacturing.		Number of negroes.	
Subscript.	Coefficient.	Subscript.	Coefficient.
18	+.959±.004	19	+.506±.038
18.3	−.091±.051	19.3	+.012±.051
18.34	−.089±.051	19.34	+.018±.051
18.35	−.181±.049	19.35	+.079±.051
18.36	−.058±.051	19.36	−.040±.051
18.37	−.090±.051	19.37	+.093±.051
18.39	−.090±.051	19.38	−.007±.051
18.345	−.182±.049	19.345	+.091±.051
18.346	−.057±.051	19.346	−.033±.051
18.347	−.088±.051	19.347	+.102±.051
18.349	−.087±.051	19.348	−.001±.051
18.356	−.149±.050	19.356	+.030±.051
18.357	−.180±.049	19.357	+.179±.049
18.359	−.170±.050	19.358	+.046±.051
18.367	−.058±.051	19.367	+.021±.051
18.369	−.067±.051	19.368	−.052±.051
18.379	−.067±.051	19.378	+.072±.051
18.3456	−.151±.050	19.3456	+.043±.051
18.3457	−.182±.049	19.3457	+.197±.049
18.3459	−.169±.050	19.3458	+.058±.051
18.3467	−.056±.051	19.3467	+.031±.051
18.3469	−.064±.051	19.3468	−.046±.051
18.3479	−.062±.051	19.3478	+.081±.051
18.3567	−.149±.050	19.3567	+.115±.050
18.3569	−.146±.050	19.3568	+.006±.051
18.3579	−.143±.050	19.3578	+.142±.050
18.3679	−.054±.051	19.3678	+.007±.051
18.34567	−.151±.050	19.34567	+.135±.050
18.34569	−.146±.050	19.34568	+.019±.051
18.34579	−.140±.050	19.34578	+.159±.050
18.34679	−.050±.051	19.34678	+.017±.051
18.35679	−.129±.050	19.35678	+.087±.051
18.345679	−.127±.050	19.345678	+.106±.051

The correlations between suicide and deaths from all other causes are negative but for the most part not over three times their probable errors. The sixth order correlation is just under three times its probable error. Thus we cannot feel confident that there is any connection between suicides and general mortality, and we may conclude

that if there is any association, it is only a slight one and in the negative direction. The increase in the proportion of suicides due to mental and physical disease noticed in the first part of this paper suggests that the decrease in the general death rate which has taken place generally in civilized countries may have been a matter of the survival of the weak, physically and mentally, to a greater age rather than any improvement in the general constitution of the population. If it be true that a lower death rate is due to the survival of a larger proportion of subnormals, a negative correlation of suicides with a general death rate is readily explicable.

The correlations of suicide with industrialization are everywhere negative but for the most part not over three times their probable errors. It is therefore uncertain whether there is any association; if there is, it is low and in the direction of lowered liability to suicide with increased industrialization. This accords with the results in the first part of the study as to the minor influence of industrialization as compared with other factors. The coefficients in which 5 occurs among the secondary subscripts are in every case larger than those in which it does not occur, i.e., the masking effect of the positive correlations of number of males with suicide and with industrialization respectively is removed by making number of males constant.

The correlation of suicide with the negro population is in most cases insignificant, the sixth order coefficient being little more than twice its probable error. In general those coefficients in which 6 and 8 occur among the secondary subscripts tend to be negative, while those with 5 and 7 among the secondary subscripts give in general higher positive values than the rest, i.e., in these cases the tendency of variations in density and industrialization to produce a positive correlation and that of masculinity of the population and general mortality to produce a negative correlation between suicide and proportion of negroes is neutralized by holding the former variables constant. The prevailing positive sign of the correlations is unexpected in view of the low suicide rates of negroes.

We have found, therefore, only one factor at all closely correlated with suicide, viz., the proportion of males in the population. This is a characteristic of the population itself, a demographic rather than an environmental factor. Yet the fact, which has been brought out in the first part of the paper, that the relative liability of males and females to suicide varies widely in different countries, so that in India the fact that the males are even less likely to commit suicide than the females seems to indicate that the relation is an effect not of an in-

herent difference between males and females but of the differing environment and traditions of the two sexes in the social organization of western countries. The correlations of suicide with precipitation, density, and age distribution are between three and four times their probable errors, and are therefore probably significant though small.

What conclusions can be drawn from the material of this and the preceding section? We have seen that the trend of the suicide rate in different countries is more closely related to a factor in the intellectual life of a country, the loss of influence of traditional institutions, the increasingly individualistic viewpoint, the decay of the group spirit, than to the economic factor of increasing industrialization, and that this result is confirmed by the lack of correlation between suicide and industrialization. The influence of the group spirit on suicide is again shown in the lower suicide rates in time of war and among the historic churches, with their emphasis on the institution rather than the individual, as well as among parents, whose interest in and sense of responsibility to their children acts as a prophylactic against suicide. The same influence appears in the distribution of suicide among different occupations.

It is of course not asserted that economic factors have no influence on suicide. In fact the high rates of the portions of the laboring classes least secure in the tenure of their employment, the hired migratory or indefinite industrial laborers, are probably due to economic pressure. However it is apparently the insecurity, the fluctuating character of their economic status, the periods of unemployment which they must undergo, which play the important part here. Those whose incomes are small but fairly secure, such as the peasant classes, show low rates. In short suicide seems to be associated not with low economic status but with adverse *changes* in economic status.

That racial factors have some influence on the differences in addiction to suicide in different countries is rendered likely by the fact that these differences persist under the changed conditions of a new country. The increase in the suicide rates of immigrants over those of their native countries as well as the difference in the liability to suicide of the two sexes which we have seen to be the most important factor in the determination of the suicide rate are probably due to the greater likelihood of immigrants and of the male sex being affected by adverse economic changes as well as to the loosening of traditional ties, the more individualistic viewpoint which is produced by the coming of the immigrant to a foreign country and by the more active contact of the male with the outside world.

TABLE LXXII.

Correlations of climatic with non-climatic factors.

Per cent. of sunshine with

Age index.		Number of males.		Area of town.	
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
2*a*4	+.071±.051	2*a*5	+.045±.051	2*a*6	+.135±.050
2*a*4.3	+.076±.051	2*a*5.3	−.147±.050	2*a*6.3	+.122±.050
2*a*4.35	+.064±.051	2*a*5.34	−.142±.050	2*a*6.34	+.118±.050
2*a*4.36	+.068±.051	2*a*5.36	−.164±.050	2*a*6.35	+.142±.050
2*a*4.37	+.075±.051	2*a*5.37	−.147±.050	2*a*6.37	+.136±.050
2*a*4.38	+.072±.051	2*a*5.38	−.097±.051	2*a*6.38	+.089±.051
2*a*4.39	+.088±.051	2*a*5.39	−.120±.050	2*a*6.39	+.088±.051
2*a*4.356	+.053±.051	2*a*5.346	−.159±.050	2*a*6.345	+.137±.050
2*a*4.357	+.064±.051	2*a*5.347	−.142±.050	2*a*6.347	+.131±.050
2*a*4.358	+.065±.051	2*a*5.348	−.092±.051	2*a*6.348	+.084±.051
2*a*4.359	+.078±.051	2*a*5.349	−.112±.050	2*a*6.349	+.082±.051
2*a*4.367	+.066±.051	2*a*5.367	−.165±.050	2*a*6.357	+.155±.050
2*a*4.368	+.066±.051	2*a*5.368	−.112±.050	2*a*6.358	+.104±.051
2*a*4.369	+.081±.051	2*a*5.369	−.135±.050	2*a*6.359	+.108±.051
2*a*4.378	+.071±.051	2*a*5.378	−.096±.051	2*a*6.378	+.102±.051
2*a*4.379	+.086±.051	2*a*5.379	−.124±.050	2*a*6.379	+.101±.051
2*a*4.389	+.081±.051	2*a*5.389	−.081±.051	2*a*6.389	+.066±.051
2*a*4.3567	+.051±.051	2*a*5.3467	−.160±.050	2*a*6.3457	+.151±.050
2*a*4.3568	+.056±.051	2*a*5.3468	−.106±.051	2*a*6.3458	+.100±.051
2*a*4.3569	+.068±.051	2*a*5.3469	−.127±.050	2*a*6.3459	+.101±.051
2*a*4.3578	+.064±.051	2*a*5.3478	−.091±.051	2*a*6.3478	+.098±.051
2*a*4.3579	+.075±.051	2*a*5.3479	−.117±.050	2*a*6.3479	+.093±.051
2*a*4.3589	+.075±.051	2*a*5.3489	−.074±.051	2*a*6.3489	+.060±.051
2*a*4.3678	+.064±.051	2*a*5.3678	−.113±.050	2*a*6.3578	+.118±.050
2*a*4.3679	+.077±.051	2*a*5.3679	−.145±.050	2*a*6.3579	+.126±.050
2*a*4.3689	+.077±.051	2*a*5.3689	−.094±.051	2*a*6.3589	+.081±.051
2*a*4.3789	+.077±.051	2*a*5.3789	−.088±.051	2*a*6.3789	+.088±.051
2*a*4.35678	+.055±.051	2*a*5.34678	−.107±.051	2*a*6.34578	+.113±.050
2*a*4.35679	+.061±.051	2*a*5.34679	−.137±.050	2*a*6.34579	+.118±.050
2*a*4.35689	+.067±.051	2*a*5.34689	−.086±.051	2*a*6.34589	+.074±.051
2*a*4.35789	+.069±.051	2*a*5.34789	−.081±.051	2*a*6.34789	+.081±.051
2*a*4.36789	+.069±.051	2*a*5.36789	−.107±.051	2*a*6.35789	+.107±.051
2*a*4.356789	+.058±.051	2*a*5.346789	−.100±.051	2*a*6.345789	+.100±.051

TABLE LXXII (*Continued*).

Per cent. of sunshine with

Deaths from all causes except suicide.		Number employed in manufacturing.		Number of negroes.	
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
2*a*7	+.073±.051	2*a*8	+.020±.051	2*a*9	+.200±.049
2*a*7.3	+.148±.050	2*a*8.3	−.287±.047	2*a*9.3	+.200±.049
2*a*7.34	+.148±.050	2*a*8.34	−.286±.047	2*a*9.34	+.204±.049
2*a*7.35	+.148±.050	2*a*8.35	−.266±.048	2*a*9.35	+.180±.049
2*a*7.36	+.159±.050	2*a*8.36	−.275±.047	2*a*9.36	+.181±.049
2*a*7.38	+.159±.050	2*a*8.37	−.293±.047	2*a*9.37	+.142±.050
2*a*7.39	+.042±.051	2*a*8.39	−.255±.048	2*a*9.38	+.147±.050
2*a*7.345	+.148±.050	2*a*8.345	−.267±.047	2*a*9.345	+.185±.049
2*a*7.346	+.159±.050	2*a*8.346	−.275±.047	2*a*9.346	+.187±.049
2*a*7.348	+.159±.050	2*a*8.347	−.292±.047	2*a*9.347	+.148±.050
2*a*7.349	+.038±.051	2*a*8.349	−.253±.048	2*a*9.348	+.152±.050
2*a*7.356	+.161±.050	2*a*8.356	−.249±.048	2*a*9.356	+.156±.050
2*a*7.358	+.158±.050	2*a*8.357	−.272±.047	2*a*9.357	+.118±.050
2*a*7.359	+.054±.051	2*a*8.359	−.240±.048	2*a*9.358	+.137±0.50
2*a*7.368	+.167±.050	2*a*8.367	−.280±.047	2*a*9.367	+.109±.051
2*a*7.369	+.064±.051	2*a*8.369	−.249±.048	2*a*9.368	+.135±.050
2*a*7.389	+.090±.051	2*a*8.379	−.267±.047	2*a*9.378	+.067±.051
2*a*7.3456	+.160±.050	2*a*8.3456	−.250±.048	2*a*9.3456	+.161±.050
2*a*7.3458	+.158±.050	2*a*8.3457	−.272±.047	2*a*9.3457	+.124±.050
2*a*7.3459	+.050±.051	2*a*8.3459	−.239±.048	2*a*9.3458	+.142±.050
2*a*7.3468	+.166±.050	2*a*8.3467	−.279±.047	2*a*9.3467	+.116±.050
2*a*7.3469	+.059±.051	2*a*8.3469	−.247±.048	2*a*9.3468	+.140±.050
2*a*7.3489	+.086±.051	2*a*8.3479	−.264±.048	2*a*9.3478	+.073±.051
2*a*7.3568	+.167±.050	2*a*8.3567	−.254±.048	2*a*9.3567	+.074±.051
2*a*7.3569	+.084±.051	2*a*8.3569	−.230±.048	2*a*9.3568	+.120±.050
2*a*7.3589	+.097±.051	2*a*8.3579	−.253±.048	2*a*9.3578	+.054±.051
2*a*7.3689	+.107±.051	2*a*8.3679	−.262±.048	2*a*9.3678	+.042±.051
2*a*7.34568	+.167±.050	2*a*8.34567	−.254±.048	2*a*9.34567	+.081±.051
2*a*7.34569	+.079±.051	2*a*8.34569	−.230±.048	2*a*9.34568	+.126±.050
2*a*7.34589	+.092±.051	2*a*8.34579	−.251±.048	2*a*9.34578	+.061±.051
2*a*7.34689	+.102±.051	2*a*8.34679	−.260±.048	2*a*9.34678	+.049±.051
2*a*7.35689	+.119±.050	2*a*8.35679	−.244±.048	2*a*9.35678	+.022±.051
2*a*7.345689	+.114±.050	2*a*8.345679	−.243±.048	2*a*9.345678	+.029±.051

TABLE LXXII (*Continued*).

Altitude with

Age index.		Number of males.		Area of town.	
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
2*b*4	+.009±.051	2*b*5	−.079±.051	2*b*6	+.007±.051
2*b*4.3	+.004±.051	2*b*5.3	+.005±.051	2*b*6.3	+.051±.051
2*b*4.35	+.004±.051	2*b*5.34	+.005±.051	2*b*6.34	+.051±.051
2*b*4.36	+.000±.051	2*b*5.36	−.001±.051	2*b*6.35	+.050±.051
2*b*4.37	+.005±.051	2*b*5.37	+.004±.051	2*b*6.37	+.043±.051
2*b*4.38	+.002±.051	2*b*5.38	+.021±.051	2*b*6.38	+.041±.051
2*b*4.39	−.000±.051	2*b*5.39	−.007±.051	2*b*6.39	+.066±.051
2*b*4.356	+.000±.051	2*b*5.346	−.001±.051	2*b*6.345	+.050±.051
2*b*4.357	+.005±.051	2*b*5.347	+.004±.051	2*b*6.347	+.042±.051
2*b*4.358	+.004±.051	2*b*5.348	+.021±.051	2*b*6.348	+.041±.051
2*b*4.359	−.001±.051	2*b*5.349	−.007±.051	2*b*6.349	+.066±.051
2*b*4.367	+.002±.051	2*b*5.367	−.001±.051	2*b*6.357	+.042±.051
2*b*4.368	−.001±.051	2*b*5.368	+.015±.051	2*b*6.358	+.038±.051
2*b*4.369	−.006±.051	2*b*5.369	−.017±.051	2*b*6.359	+.068±.051
2*b*4.378	+.003±.051	2*b*5.378	+.019±.051	2*b*6.378	+.033±.051
2*b*4.379	+.004±.051	2*b*5.379	+.001±.051	2*b*6.379	+.049±.051
2*b*4.389	−.004±.051	2*b*5.389	+.009±.051	2*b*6.389	+.057±.051
2*b*4.3567	+.002±.051	2*b*5.3467	−.001±.051	2*b*6.3457	+.042±.051
2*b*4.3568	+.000±.051	2*b*5.3468	+.015±.051	2*b*6.3458	+.038±.051
2*b*4.3569	−.007±.051	2*b*5.3469	−.018±.051	2*b*6.3459	+.068±.051
2*b*4.3578	+.005±.051	2*b*5.3478	+.019±.051	2*b*6.3478	+.033±.051
2*b*4.3579	+.004±.051	2*b*5.3479	+.001±.051	2*b*6.3479	+.049±.051
2*b*4.3589	−.003±.051	2*b*5.3489	+.009±.051	2*b*6.3489	+.058±.051
2*b*4.3678	+.001±.051	2*b*5.3678	+.014±.051	2*b*6.3578	+.030±.051
2*b*4.3679	−.001±.051	2*b*5.3679	−.008±.051	2*b*6.3579	+.049±.051
2*b*4.3689	−.008±.051	2*b*5.3689	−.000±.051	2*b*6.3589	+.057±.051
2*b*4.3789	+.000±.051	2*b*5.3789	+.014±.051	2*b*6.3789	+.044±.051
2*b*4.35678	+.002±.051	2*b*5.34678	+.014±.051	2*b*6.34578	+.030±.051
2*b*4.35679	−.002±.051	2*b*5.34679	−.008±.051	2*b*6.34579	+.049±.051
2*b*4.35689	−.008±.051	2*b*5.34689	−.001±.051	2*b*6.34589	+.057±.051
2*b*4.35789	+.001±.051	2*b*5.34789	+.014±.051	2*b*6.34789	+.044±.051
2*b*4.36789	−.004±.051	2*b*5.36789	+.006±.051	2*b*6.35789	+.042±.051
2*b*4.356789	−.003±.051	2*b*5.346789	+.005±.051	2*b*6.345789	+.042±.051

TABLE LXXII (*Continued*).

Altitude with

Deaths from all causes except suicide.		Number employed in manufacturing.		Number of negroes.	
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
2*b*7	−.091±.051	2*b*8	−.089±.051	2*b*9	−.105±.051
2*b*7.3	−.110±.051	2*b*8.3	−.077±.051	2*b*9.3	−.075±.051
2*b*7.34	−.110±.051	2*b*8.34	−.077±.051	2*b*9.34	−.075±.051
2*b*7.35	−.110±.051	2*b*8.35	−.080±.051	2*b*9.35	−.075±.051
2*b*7.36	−.107±.051	2*b*8.36	−.071±.051	2*b*9.36	−.086±.051
2*b*7.38	−.109±.051	2*b*8.37	−.076±.051	2*b*9.37	−.015±.051
2*b*7.39	−.082±.051	2*b*8.39	−.096±.051	2*b*9.38	−.094±.051
2*b*7.345	−.110±.051	2*b*8.345	−.080±.051	2*b*9.345	−.075±.051
2*b*7.346	−.107±.051	2*b*8.346	−.071±.051	2*b*9.346	−.086±.051
2*b*7.348	−.109±.051	2*b*8.347	−.076±.051	2*b*9.347	−.015±.051
2*b*7.349	−.082±.051	2*b*8.349	−.096±.051	2*b*9.348	−.094±.051
2*b*7.356	−.107±.051	2*b*8.356	−.073±.051	2*b*9.356	−.088±.051
2*b*7.358	−.109±.051	2*b*8.357	−.078±.051	2*b*9.357	−.014±.051
2*b*7.359	−.082±.051	2*b*8.359	−.096±.051	2*b*9.358	−.092±.051
2*b*7.368	−.107±.051	2*b*8.367	−.071±.051	2*b*9.367	−.028±.051
2*b*7.369	−.069±.051	2*b*8.369	−.090±.051	2*b*9.368	−.102±.051
2*b*7.389	−.067±.051	2*b*8.379	−.083±.051	2*b*9.378	−.037±.051
2*b*7.3456	−.107±.051	2*b*8.3456	−.073±.051	2*b*9.3456	−.088±.051
2*b*7.3458	−.109±.051	2*b*8.3457	−.078±.051	2*b*9.3457	−.014±.051
2*b*7.3459	−.082±.051	2*b*8.3459	−.096±.051	2*b*9.3458	−.092±.051
2*b*7.3468	−.107±.051	2*b*8.3467	−.071±.051	2*b*9.3467	−.028±.051
2*b*7.3469	−.069±.051	2*b*8.3469	−.090±.051	2*b*9.3468	−.103±.051
2*b*7.3489	−.067±.051	2*b*8.3479	−.083±.051	2*b*9.3478	−.037±.051
2*b*7.3568	−.107±.051	2*b*8.3567	−.072±.051	2*b*9.3567	−.029±.051
2*b*7.3569	−.067±.051	2*b*8.3569	−.088±.051	2*b*9.3568	−.101±.051
2*b*7.3589	−.068±.051	2*b*8.3579	−.084±.051	2*b*9.3578	−.035±.051
2*b*7.3689	−.056±.051	2*b*8.3679	−.080±.051	2*b*9.3678	−.047±.051
2*b*7.34568	−.107±.051	2*b*8.34567	−.072±.051	2*b*9.34567	−.029±.051
2*b*7.34569	−.067±.051	2*b*8.34569	−.088±.051	2*b*9.34568	−.102±.051
2*b*7.34589	−.068±.051	2*b*8.34579	−.084±.051	2*b*9.34578	−.035±.051
2*b*7.34689	−.055±.051	2*b*8.34679	−.081±.051	2*b*9.34678	−.047±.051
2*b*7.35689	−.056±.051	2*b*8.35679	−.080±.051	2*b*9.35678	−.045±.051
2*b*7.345689	−.056±.051	2*b*8.345679	−.080±.051	2*b*9.345678	−.045±.051

TABLE LXXII (*Continued*).

Precipitation with

Age index.		Number of males.		Area of town.	
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
2*c*4	−.170±.050	2*c*5	+.042±.051	2*c*6	−.128±.050
2*c*4.3	−.167±.050	2*c*5.3	−.137±.050	2*c*6.3	−.173±.050
2*c*4.35	−.181±.049	2*c*5.34	−.154±.050	2*c*6.34	−.164±.050
2*c*4.36	−.157±.050	2*c*5.36	−.120±.050	2*c*6.35	−.160±.050
2*c*4.37	−.173±.050	2*c*5.37	−.137±.050	2*c*6.37	−.161±.050
2*c*4.38	−.166±.050	2*c*5.38	−.147±.050	2*c*6.38	−.170±.050
2*c*4.39	−.159±.050	2*c*5.39	−.090±.051	2*c*6.39	−.255±.048
2*c*4.356	−.170±.050	2*c*5.346	−.137±.050	2*c*6.345	−.148±.050
2*c*4.357	−.187±.049	2*c*5.347	−.155±.050	2*c*6.347	−.151±.050
2*c*4.358	−.181±.049	2*c*5.348	−.163±.050	2*c*6.348	−.161±.050
2*c*4.359	−.169±.050	2*c*5.349	−.107±.051	2*c*6.349	−.246±.048
2*c*4.367	−.164±.050	2*c*5.367	−.121±.050	2*c*6.357	−.148±.050
2*c*4.368	−.157±.050	2*c*5.368	−.125±.050	2*c*6.358	−.152±.050
2*c*4.369	−.143±.050	2*c*5.369	−.054±.051	2*c*6.359	−.246±.048
2*c*4.378	−.172±.050	2*c*5.378	−.146±.050	2*c*6.378	−.159±.050
2*c*4.379	−.160±.050	2*c*5.379	−.092±.051	2*c*6.379	−.258±.048
2*c*4.389	−.156±.050	2*c*5.389	−.111±.051	2*c*6.389	−.247±.048
2*c*4.3567	−.177±.050	2*c*5.3467	−.139±.050	2*c*6.3457	−.135±.050
2*c*4.3568	−.171±.050	2*c*5.3468	−.142±.050	2*c*6.3458	−.140±.050
2*c*4.3569	−.150±.050	2*c*5.3469	−.071±.051	2*c*6.3459	−.234±.048
2*c*4.3578	−.187±.049	2*c*5.3478	−.163±.050	2*c*6.3478	−.149±.050
2*c*4.3579	−.171±.050	2*c*5.3479	−.110±.051	2*c*6.3479	−.247±.048
2*c*4.3589	−.168±.050	2*c*5.3489	−.127±.050	2*c*6.3489	−.238±.048
2*c*4.3678	−.163±.050	2*c*5.3678	−.126±.050	2*c*6.3578	−.140±.050
2*c*4.3679	−.141±.050	2*c*5.3679	−.049±.051	2*c*6.3579	−.247±.048
2*c*4.3689	−.141±.050	2*c*5.3689	−.073±.051	2*c*6.3589	−.233±.048
2*c*4.3789	−.156±.050	2*c*5.3789	−.112±.050	2*c*6.3789	−.253±.048
2*c*4.35678	−.177±.050	2*c*5.34678	−.144±.050	2*c*6.34578	−.127±.050
2*c*4.35679	−.148±.050	2*c*5.34679	−.067±.051	2*c*6.34579	−.232±.048
2*c*4.35689	−.150±.050	2*c*5.34689	−.089±.051	2*c*6.34589	−.221±.049
2*c*4.35789	−.169±.050	2*c*5.34789	−.128±.050	2*c*6.34789	−.243±.048
2*c*4.36789	−.137±.050	2*c*5.36789	−.067±.051	2*c*6.35789	−.238±.048
2*c*4.356789	−.146±.050	2*c*5.346789	−.084±.051	2*c*6.345789	−.223±.049

TABLE LXXII (*Continued*).

Precipitation with

Deaths from all causes except suicide.		Number employed in manufacturing.		Number of negroes.	
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
2*c*7	+.074±.051	2*c*8	+.057±.051	2*c*9	+.315±.046
2*c*7.3	+.207±.049	2*c*8.3	+.034±.051	2*c*9.3	+.337±.045
2*c*7.34	+.212±.049	2*c*8.34	+.030±.051	2*c*9.34	+.333±.045
2*c*7.35	+.207±.049	2*c*8.35	+.062±.051	2*c*9.35	+.322±.046
2*c*7.36	+.197±.049	2*c*8.36	+.011±.051	2*c*9.36	+.382±.044
2*c*7.38	+.207±.049	2*c*8.37	+.031±.051	2*c*9.37	+.272±.047
2*c*7.39	+.018±.051	2*c*8.39	+.116±.050	2*c*9.38	+.353±.045
2*c*7.345	+.212±.049	2*c*8.345	+.062±.051	2*c*9.345	+.316±.046
2*c*7.346	+.202±.049	2*c*8.346	+.009±.051	2*c*9.346	+.377±.044
2*c*7.348	+.211±.049	2*c*8.347	+.028±.051	2*c*9.347	+.265±.048
2*c*7.349	+.026±.051	2*c*8.349	+.111±.051	2*c*9.348	+.348±.045
2*c*7.356	+.198±.049	2*c*8.356	+.037±.051	2*c*9.356	+.369±.044
2*c*7.358	+.207±.049	2*c*8.357	+.060±.051	2*c*9.357	+.254±.048
2*c*7.359	+.027±.051	2*c*8.359	+.133±.050	2*c*9.358	+.341±.045
2*c*7.368	+.197±.049	2*c*8.367	+.010±.051	2*c*9.367	+.336±.045
2*c*7.369	−.043±.051	2*c*8.369	+.094±.051	2*c*9.368	+.391±.043
2*c*7.389	−.002±.051	2*c*8.379	+.114±.050	2*c*9.378	+.292±.047
2*c*7.3456	+.204±.049	2*c*8.3456	+.039±.051	2*c*9.3456	+.361±.044
2*c*7.3458	+.212±.049	2*c*8.3457	+.059±.051	2*c*9.3457	+.242±.048
2*c*7.3459	+.037±.051	2*c*8.3459	+.131±.050	2*c*9.3458	+.335±.045
2*c*7.3468	+.202±.049	2*c*8.3467	+.008±.051	2*c*9.3467	+.326±.046
2*c*7.3469	−.033±.051	2*c*8.3469	+.091±.051	2*c*9.3468	+.386±.044
2*c*7.3489	+.007±.051	2*c*8.3479	+.109±.051	2*c*9.3478	+.283±.047
2*c*7.3568	+.198±.049	2*c*8.3567	+.037±.051	2*c*9.3567	+.319±.046
2*c*7.3569	−.036±.051	2*c*8.3569	+.106±.051	2*c*9.3568	+.380±.044
2*c*7.3589	+.006±.051	2*c*8.3579	+.131±.050	2*c*9.3578	+.277±.047
2*c*7.3689	−.058±.051	2*c*8.3679	+.102±.051	2*c*9.3678	+.349±.045
2*c*7.34568	+.204±.049	2*c*8.34567	+.039±.051	2*c*9.34567	+.305±.046
2*c*7.34569	−.023±.051	2*c*8.34569	+.106±.051	2*c*9.34568	+.372±.044
2*c*7.34589	+.017±.051	2*c*8.34579	+.127±.050	2*c*9.34578	+.266±.048
2*c*7.34689	−.048±.051	2*c*8.34679	+.098±.051	2*c*9.34678	+.339±.045
2*c*7.35689	−.051±.051	2*c*8.35679	+.112±.050	2*c*9.35678	+.334±.045
2*c*7.345689	−.038±.051	2*c*8.345679	+.110±.051	2*c*9.345678	+.320±.046

TABLE LXXII (*Continued*).

Mean Temperature with

Age index.		Number of males.		Area of town.	
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
2*d*4	−.069±.051	2*d*5	+.040±.051	2*d*6	+.185±.049
2*d*4.3	−.065±.051	2*d*5.3	−.149±.050	2*d*6.3	+.182±.049
2*d*4.35	−.079±.051	2*d*5.34	−.155±.050	2*d*6.34	+.187±.049
2*d*4.36	−.080±.051	2*d*5.36	−.174±.050	2*d*6.35	+.203±.049
2*d*4.37	−.072±.051	2*d*5.37	−.153±.050	2*d*6.37	+.219±.049
2*d*4.38	−.078±.051	2*d*5.38	−.090±.051	2*d*6.38	+.146±.050
2*d*4.39	−.044±.051	2*d*5.39	−.074±.051	2*d*6.39	+.095±.051
2*d*4.356	−.098±.051	2*d*5.346	−.183±.049	2*d*6.345	+.210±.049
2*d*4.357	−.087±.051	2*d*5.347	−.160±.050	2*d*6.347	+.226±.049
2*d*4.358	−.086±.051	2*d*5.348	−.097±.051	2*d*6.348	+.152±.050
2*d*4.359	−.051±.051	2*d*5.349	−.078±.051	2*d*6.349	+.099±.051
2*d*4.367	−.091±.051	2*d*5.367	−.184±.049	2*d*6.357	+.241±.048
2*d*4.368	−.090±.051	2*d*5.368	−.113±.050	2*d*6.358	+.161±.050
2*d*4.369	−.053±.051	2*d*5.369	−.089±.051	2*d*6.359	+.107±.051
2*d*4.378	−.087±.051	2*d*5.378	−.090±.051	2*d*6.378	+.185±.049
2*d*4.379	−.045±.051	2*d*5.379	−.075±.051	2*d*6.379	+.099±.051
2*d*4.389	−.056±.051	2*d*5.389	−.030±.051	2*d*6.389	+.071±.051
2*d*4.3567	−.111±.051	2*d*5.3467	−.194±.049	2*d*6.3457	+.250±.048
2*d*4.3568	−.101±.051	2*d*5.3468	−.123±.050	2*d*6.3458	+.170±.050
2*d*4.3569	−.063±.051	2*d*5.3469	−.095±.051	2*d*6.3459	+.113±.050
2*d*4.3578	−.095±.051	2*d*5.3478	−.097±.051	2*d*6.3478	+.192±.049
2*d*4.3579	−.052±.051	2*d*5.3479	−.079±.051	2*d*6.3479	+.104±.051
2*d*4.3589	−.059±.051	2*d*5.3489	−.035±.051	2*d*6.3489	+.076±.051
2*d*4.3678	−.102±.051	2*d*5.3678	−.120±.050	2*d*6.3578	+.201±.049
2*d*4.3679	−.055±.051	2*d*5.3679	−.094±.051	2*d*6.3579	+.114±.050
2*d*4.3689	−.062±.051	2*d*5.3689	−.043±.051	2*d*6.3589	+.077±.051
2*d*4.3789	−.059±.051	2*d*5.3789	−.034±.051	2*d*6.3789	+.085±.051
2*d*4.35678	−.115±.050	2*d*5.34678	−.130±.050	2*d*6.34578	+.210±.049
2*d*4.35679	−.067±.051	2*d*5.34679	−.101±.051	2*d*6.34579	+.121±.050
2*d*4.35689	−.067±.051	2*d*5.34689	−.049±.051	2*d*6.34589	+.084±.051
2*d*4.35789	−.063±.051	2*d*5.34789	−.040±.051	2*d*6.34789	+.092±.051
2*d*4.36789	−.068±.051	2*d*5.36789	−.051±.051	2*d*6.35789	+.093±.051
2*d*4.356789	−.075±.051	2*d*5.346789	−.059±.051	2*d*6.345789	+.102±.051

TABLE LXXII (*Continued*).

Mean temperature with

Deaths from all causes except suicide.		Number employed in manufacturing.		Number of negroes.	
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
2*d*7	+.086±.051	2*d*8	+.008±.051	2*d*9	+.504±.038
2*d*7.3	+.325±.046	2*d*8.3	−.341±.045	2*d*9.3	+.559±.035
2*d*7.34	+.326±.046	2*d*8.34	−.343±.045	2*d*9.34	+.558±.035
2*d*7.35	+.326±.046	2*d*8.35	−.322±.046	2*d*9.35	+.548±.036
2*d*7.36	+.345±.045	2*d*8.36	−.325±.046	2*d*9.36	+.543±.036
2*d*7.38	+.351±.045	2*d*8.37	−.366±.044	2*d*9.37	+.481±.039
2*d*7.39	+.006±.051	2*d*8.39	−.272±.047	2*d*9.38	+.529±.037
2*d*7.345	+.328±.046	2*d*8.345	−.323±.046	2*d*9.345	+.546±.036
2*d*7.346	+.348±.045	2*d*8.346	−.327±.046	2*d*9.346	+.541±.036
2*d*7.348	+.353±.045	2*d*8.347	−.368±.044	2*d*9.347	+.479±.039
2*d*7.349	+.009±.051	2*d*8.349	−.274±.047	2*d*9.348	+.527±.037
2*d*7.356	+.350±.045	2*d*8.356	−.299±.047	2*d*9.356	+.528±.037
2*d*7.358	+.351±.045	2*d*8.357	−.346±.045	2*d*9.357	+.466±.040
2*d*7.359	+.014±.051	2*d*8.359	−.264±.048	2*d*9.358	+.524±.037
2*d*7.368	+.367±.044	2*d*8.367	−.348±.045	2*d*9.367	+.448±.041
2*d*7.369	+.029±.051	2*d*8.369	−.265±.048	2*d*9.368	+.517±.037
2*d*7.389	+.056±.051	2*d*8.379	−.277±.047	2*d*9.378	+.426±.042
2*d*7.3456	+.353±.045	2*d*8.3456	−.300±.047	2*d*9.3456	+.524±.037
2*d*7.3458	+.353±.045	2*d*8.3457	−.348±.045	2*d*9.3457	+.462±.040
2*d*7.3459	+.017±.051	2*d*8.3459	−.266±.048	2*d*9.3458	+.521±.037
2*d*7.3468	+.370±.044	2*d*8.3467	−.351±.045	2*d*9.3467	+.443±.041
2*d*7.3469	+.033±.051	2*d*8.3469	−.267±.047	2*d*9.3468	+.514±.038
2*d*7.3489	+.060±.051	2*d*8.3479	−.280±.047	2*d*9.3478	+.422±.042
2*d*7.3568	+.368±.044	2*d*8.3567	−.321±.046	2*d*9.3567	+.424±.042
2*d*7.3569	+.042±.051	2*d*8.3569	−.254±.048	2*d*9.3568	+.509±.038
2*d*7.3589	+.059±.051	2*d*8.3579	−.270±.047	2*d*9.3578	+.419±.042
2*d*7.3689	+.074±.051	2*d*8.3679	−.273±.047	2*d*9.3678	+.398±.043
2*d*7.34568	+.372±.044	2*d*8.34567	−.323±.046	2*d*9.34567	+.417±.042
2*d*7.34569	+.047±.051	2*d*8.34569	−.255±.048	2*d*9.34568	+.505±.038
2*d*7.34589	+.062±.051	2*d*8.34579	−.272±.047	2*d*9.34578	+.414±.042
2*d*7.34689	+.079±.051	2*d*8.34679	−.276±.047	2*d*9.34678	+.392±.043
2*d*7.35689	+.079±.051	2*d*8.35679	−.263±.048	2*d*9.35678	+.385±.044
2*d*7.345689	+.085±.051	2*d*8.345679	−.265±.048	2*d*9.345678	+.377±.044

The increase in the proportion of suicides attributed to physical and mental illness which has coincided with the increase in suicide rate suggests that the latter may be due in part to an increase in the frequency of physical and mental invalidism.

Although we have now completed the consideration of the correlation of suicide with the other factors which we have chosen, the correlations of these factors with each other are not only necessary in the calculation of the correlations with suicide but are of some interest in themselves. Table LXXII gives the correlations of the climatic with the non-climatic factors.

Per cent. of sunshine is not significantly correlated with age index, number of males, or area of town. The lack of significant correlation between sunshine and the general death rate may signify that sunshine has no such marked influence on health as is often supposed, or may be due to the counteracting effect of two factors on each other. Health resorts, which have of course higher death rates than the average city, are generally so situated as to have a large amount of sunshine. This might mask any connection between sunshine and death rate.

The correlation between sunshine and industrialization is negative, and although not large, is significant, being in all cases five times its probable error or more. The association is probably in the main a result of the greater smokiness of the atmosphere in an industrial city, which reduces the amount of sunshine materially.

The correlation of sunshine with number of negroes, which is significant in the lower orders, is little more than half its probable error in the sixth order. This indicates that the high proportion of negroes in the "sunny South" is only indirectly related to its abundance of sunshine.

Altitude is not significantly correlated with any of the non-climatic factors.

The correlations of precipitation with age index and number of males are not significant. The correlation of the sixth order between precipitation and area of town is more than four times its probable error, i.e., significant. It is negative in sign, indicating that in arid regions cities tend to spread out over more ground. Those correlations in which 9 occurs as a secondary subscript are uniformly higher than those in which it does not occur, the correlation of the negro population with high precipitation and with large area masking the negative correlation between the two latter factors.

The correlation of general death rate with precipitation is positive and significant so long as the proportion of negroes is not held constant

but becomes wholly insignificant as soon as that is done. Apparently precipitation has no influence on the general death rate, although here as in the similar case of sunshine a correlation due to heterogeneity between health resorts and other cities may mask a correlation in the opposite direction.

The correlation of precipitation with industrialization is not significant, but that with number of negroes is positive, significant, and fairly large. The negro as an agricultural laborer has always been confined to the South and while of late the race has migrated to an increasing degree to other sections to fill the demand for other kinds of unskilled labor, its migration has been northward rather than towards the drier regions farther west. The concentration of negro agricultural labor in the South is explicable on economic grounds, cotton, the principal Southern crop, being the only important crop to the cultivation and gathering of which machinery has never been applied to any appreciable extent. The demand for unskilled agricultural labor has thus been greater in the South than in other sections of the country. It is quite probable, however, that a racial preference for regions of heavy or moderate precipitation over arid regions plays a part in the distribution of negroes in the United States. It should not be forgotten that their principal habitat in Africa is the damp equatorial forest and that the Sahara has always been a barrier to the extension of the negro race.

The correlations of mean temperature with age index are in no instance significant. The correlations of temperature with number of males are over three times their probable errors when industrialization and number of negroes vary but are much smaller when these factors are held constant.

The correlations of mean temperature with area of town are more than three—in some cases more than four times their probable errors as long as number of negroes is allowed to vary, but become insignificant as soon as this factor is held constant. This is an interesting and somewhat unexpected result. It would seem *a priori* that temperature should have an effect on the planning of a city, quite independent of the racial constitution of the community. However this seems not to be the case.

The correlations of mean temperature with general death rate are significant and fairly high as long as number of negroes varies, but become insignificant with that factor constant. All four of the climatic factors show, therefore, no significant correlation with general death rate. Unless there is a masking effect of heterogeneity in the

cities dealt with, this would indicate that mean climatic conditions have little or no effect on the mortality of a community.

The correlations of mean temperature with industrialization are in all cases significant but are lower for constant number of negroes than when this factor varies. They are negative in sign, i.e., even apart from the inaptitude of the negro for industrial life and the consequent retardation of industrial development in regions with a large negro population, cities in warm climates are less industrialized than those in more temperate latitudes.

The correlations of mean temperature with number of negroes are in all cases significant and fairly high. The remarks on the correlation of precipitation with number of negroes apply here also, although the negroes have of late years shown a greater tendency to migrate to colder climates than to arid regions. However the excess of deaths over births which they show in the North indicates very plainly how poorly adapted the race is to live in cold climates.

TABLE LXXIII.

Correlations of non-climatic factors with one another.

Age index with

Number of males.		Area of town.	
Subscript.	Coefficient.	Subscript.	Coefficient.
45	−.077±.051	46	+.031±.051
45.3	−.085±.051	46.3	+.072±.051
45.36	−.094±.051	46.35	+.083±.051
45.37	−.084±.051	46.37	+.073±.051
45.38	−.081±.051	46.38	+.070±.051
45.39	−.094±.051	46.39	+.084±.051
45.367	−.094±.051	46.357	+.084±.051
45.368	−.093±.051	46.358	+.083±.051
45.369	−.108±.051	46.359	+.099±.051
45.378	−.081±.051	46.378	+.071±.051
45.379	−.099±.051	46.379	+.097±.051
45.389	−.089±.051	46.389	+.081±.051
45.3678	−.093±.051	46.3578	+.084±.051
45.3679	−.119±.050	46.3579	+.117±050
45.3689	−.105±.051	46.3589	+.097±.051
45.3789	−.094±.051	46.3789	+.095±.051
45.36789	−.114±.050	46.35789	+.115±.050

TABLE LXXIII (*Continued*).

Age index with			
Deaths from all causes except suicide.		Number employed in manufacturing.	
Subscript.	Coefficient.	Subscript.	Coefficient.
47	−.068±.051	48	−.072±.051
47.3	+.010±.051	48.3	−.024±.051
47.35	+.009±.051	48.35	−.008±.051
47.36	+.016±.051	48.36	−.015±.051
47.38	+.010±.051	48.37	−.024±.051
47.39	+.048±.051	48.39	−.036±.051
47.356	+.015±.051	48.356	+.005±.051
47.358	+.009±.051	48.357	−.008±.051
47.359	+.058±.051	48.359	−.021±.051
47.368	+.016±.051	48.367	−.015±.051
47.369	+.069±.051	48.369	−.028±.051
47.389	+.055±.051	48.379	−.045±.051
47.3568	+.015±.051	48.3567	+.005±.051
47.3569	+.085±.051	48.3569	−.009±.051
47.3589	+.062±.051	48.3579	−.031±.051
47.3689	+.075±.051	48.3679	−.040±.051
47.35689	+.087±.051	48.35679	−.020±.051

The correlations of non-climatic factors with one another are shown in Table LXXIII. Age index is not significantly correlated with any of the other factors. The lack of correlation with general mortality is rather unexpected in view of the differences in specific death rates for different ages.

Number of males is significantly correlated with area of town in the higher order coefficients, i.e., where disturbing influences are removed the less densely populated cities have the largest proportion of males. This is no doubt due to the influence of the western cities in which density is low and proportion of males high. Within any one section of the country the larger, more densely populated cities would draw men from the smaller cities.

Number of males is not significantly correlated with general mortality, another unexpected result in view of the less favorable specific death rates of males as compared with females.

The fifth order correlation of number of males with industrializa-

tion is probably significant. In spite of the increasing occupation of women in industry, males still predominate and are therefore likely to form a larger proportion of the population of industrial than of non-industrial communities.

The negative correlation in the fifth order of number of males with number of negroes is just four times its probable error. Apparently there is a low but significant correlation produced by some relation between the two factors other than the retarding influence of a large negro population on industrial development.

The correlation between area of town and general mortality, which is less than twice its probable error when the number of negroes varies, is more than four times its probable error when this disturbing factor is removed. There is therefore a low but significant positive correlation between the density of population in a town and its general mortality when age, sex, industrialization, and proportion of negroes are constant. The influence of density of population on mortality,

TABLE LXXIII (*Continued*).

Age index with		Number of males with	
Number of negroes.		Area of town.	
Subscript.	Coefficient.	Subscript.	Coefficient.
49	−.080±.051	56	+.475±.040
49.3	−.051±.051	56.3	+.115±.050
49.35	−.066±.051	56.34	+.122±.050
49.36	−.066±.051	56.37	+.115±.050
49.37	−.069±.051	56.38	+.146±.050
49.38	−.058±.051	56.39	+.150±.050
49.356	−.085±.051	56.347	+.122±.050
49.357	−.087±.051	56.348	+.152±.050
49.358	−.068±.051	56.349	+.159±.050
49.367	−.094±.051	56.378	+.145±.050
49.368	−.070±.051	56.379	+.177±.050
49.378	−.079±.051	56.389	+.169±.050
49.3567	−.119±.050	56.3478	+.151±.050
49.3568	−.085±.051	56.3479	+.189±.049
49.3578	−.092±.051	56.3489	+.177±.050
49.3678	−.101±.051	56.3789	+.189±.049
49.35678	−.121±.050	56.34789	+.200±.049

TABLE LXXIII (*Continued*).

Number of males with

Deaths from all causes except suicide.		Number employed in manufacturing.	
Subscript.	Coefficient.	Subscript.	Coefficient.
57	+.991±.001	58	+.990±.001
57.3	−.013±.051	58.3	+.195±.049
57.34	−.012±.051	58.34	+.194±.049
57.36	−.004±.051	58.36	+.214±.049
57.38	−.016±.051	58.37	+.195±.049
57.39	+.096±.051	58.39	+.167±.050
57.346	−.003±.051	58.346	+.213±.049
57.348	−.016±.051	58.347	+.194±.049
57.349	+.101±.051	58.349	+.164±.050
57.368	−.005±.051	58.367	+.214±.049
57.369	+.135±.050	58.369	+.184±.049
57.389	+.069±.051	58.379	+.153±.050
57.3468	−.004±.051	58.3467	+.213±.049
57.3469	+.144±.050	58.3469	+.182±.049
57.3489	+.075±.051	58.3479	+.149±.050
57.3689	+.110±.051	58.3679	+.167±.050
57.34689	+.119±.050	58.34679	+.163±.050

on which Farr laid so much stress, is therefore real, although not the major element in the determination of mortality which he supposed it to be.

The correlation of area of town with industrialization is not significant, but that with number of negroes is significant. Southern cities are in general less densely settled than those in the North. It has already been remarked in considering mean temperature that when the effect of the negro population was removed there was no significant correlation between temperature and density of population.

The correlation of general mortality with industrialization is positive in sign but not significant. If there is any tendency for manufacturing towns to have high death rates—the observed association might easily be due to random sampling, it is a small factor in determining the magnitude of the general death rate. The correlation on the other hand between the negro element and the general mortality is the highest we have found in this study, higher than the correlations

between the characters of parent and offspring which have been determined for various species. The most important factor in determining the mortality of a city, far more important than any of the climatic factors, than age or sex distribution of the population, or than industrialization, is the proportion of negroes in its population. Even density, although it has a significant effect on mortality, is less than half as influential as this element of racial composition.

There is a significant negative correlation between the proportion of negroes and the degree of industrialization. The retarding effect of a large negro element on industrial development has already been noticed.

TABLE LXXIII (*Continued*).

Number of males with		Area of town with	
Number of negroes.		Deaths from all causes except suicide.	
Subscript.	Coefficient.	Subscript.	Coefficient.
59	+.506±.038	67	+.459±.040
59.3	−.159±.050	67.3	−.077±.051
59.34	−.164±.050	67.34	−.078±.051
59.36	−.185±.049	67.35	−.076±.051
59.37	−.185±.049	67.38	−.076±.051
59.38	−.122±.050	67.39	−.229±.048
59.346	−.192±.049	67.345	−.077±.051
59.347	−.192±.049	67.348	−.076±.051
59.348	−.127±.050	67.349	−.234±.048
59.367	−.228±.048	67.358	−.074±.051
59.368	−.149±.050	67.359	−.247±.048
59.378	−.139±.050	67.389	−.216±.049
59.3467	−.239±.048	67.3458	−.075±.051
59.3468	−.157±.050	67.3459	−.254±.048
59.3478	−.147±.050	67.3489	−.222±.049
59.3678	−.185±.049	67.3589	−.232±.048
59.34678	−.196±.049	67.34589	−.239±.048

TABLE LXXIII (*Continued*).

Area of town with

Number employed in manufacturing.		Number of negroes.	
Subscript.	Coefficient.	Subscript.	Coefficient.
68	+.449±.041	69	+.385±.044
68.3	−.134±.050	69.3	+.187±.049
68.34	−.133±.050	69.34	+.192±.049
68.35	−.161±.050	69.35	+.210±.049
68.37	−.133±.050	69.37	+.283±.047
68.39	−.097±.051	69.38	+.164±.050
68.345	−.160±.050	69.345	+.216±.049
68.347	−.132±.050	69.347	+.290±.047
68.349	−.095±.051	69.348	+.168±.050
68.357	−.160±.050	69.357	+.312±.046
68.359	−.126±.050	69.358	+.185±.049
68.379	−.061±.051	69.378	+.259±.048
68.3457	−.160±.050	69.3457	+.321±.046
68.3459	−.124±.050	69.3458	+.192±.049
68.3479	−.056±.051	69.3478	+.266±.048
68.3579	−.090±.051	69.3578	+.285±.047
68.34579	−.087±.051	69.34578	+.294±.047

Deaths from all causes except suicide with				Number employed in manufacturing with	
Number employed in manufacturing.		Number of negroes.		Number of negroes.	
Subscript.	Coefficient.	Subscript.	Coefficient.	Subscript.	Coefficient.
78	+.987±.001	79	+.567±.035	89	+.491±.039
78.3	+.014±.051	79.3	+.573±.034	89.3	−.216±.049
78.34	+.015±.051	79.34	+.574±.034	89.34	−.217±.049
78.35	+.017±.051	79.35	+.578±.034	89.35	−.191±.049
78.36	+.004±.051	79.36	+.600±.033	89.36	−.196±.049
78.39	+.173±.050	79.38	+.590±.033	89.37	−.273±.047
78.345	+.017±.051	79.345	+.580±.034	89.345	−.192±.049
78.346	+.004±.051	79.346	+.602±.033	89.346	−.197±.049
78.349	+.175±.050	79.348	+.592±.033	89.347	−.276±.047
78.356	+.005±.051	79.356	+.609±.032	89.356	−.163±.050
78.359	+.159±.050	79.358	+.593±.033	89.357	−.246±.048
78.369	+.155±.050	79.368	+.612±.032	89.367	−.248±.048
78.3456	+.005±.051	79.3456	+.613±.032	89.3456	−.163±.050
78.3459	+.161±.050	79.3458	+.595±.033	89.3457	−.248±.048
78.3469	+.157±.050	79.3468	+.615±.032	89.3467	−.251±.048
78.3569	+.134±.050	79.3568	+.619±.032	89.3567	−.210±.049
78.34569	+.135±.050	79.34568	+.622±.031	89.34567	−.210±.049

Summary.

I.

1. The general trend of suicide rates has been upward during the past century, but the higher rates especially tend to become stabilized. A factor in the upward trend is found in the decay of the group spirit. The European war has produced a sharp decline. The trend of suicide is in the opposite direction to the general death rate.

2. Germany, France, Denmark and Sweden show high suicide rates; the British Isles, Norway, Netherlands, and south and east of Europe show low rates. These differences persist in the United States among immigrants, whose suicide rate is however much higher than that of home country. Japan and China have high rates, India low. In the United States, rates are lowest in south, highest in west.

3. The maximum frequency of suicide occurs in May or June, the minimum in December or January. This appears to be an effect of weather *per se*.

4. The lowest suicide rates are shown by the Greek church, followed by Roman Catholics and Protestants. Jewish rates have increased rapidly.

5. Urban suicide rates are higher than rural.

6. Suicide is more frequent among males in occidental countries, but among females in India.

7. The suicide rate increases in general with age, but with diminishing velocity. The female rate comes nearest to the male in adolescence.

8. In general the married show lower suicide rates than the single or widowed. The divorced have high rates. Parents show lower rates than the childless.

9. Suicide rates are low among farmers and others employed in steady manual labor in the open air, while the professions (except the clergy and teachers), officials, capitalists, soldiers, innkeepers, and migratory laborers show high rates. Low economic status, when stable, is associated in general with low suicide rates.

10. In western Europe mental disease is the most frequent motive of suicide. Both mental and physical diseases are increasing in importance as motives.

11. The usual order of preference as to method of suicide is hanging, drowning, shooting, cutting. Males show a greater disposition to hanging, cutting, and shooting; females to drowning, poison, throwing self from height, and asphyxia.

II.

A study by the method of partial correlation, based on 174 American cities, of the relation of suicide to climatic and other factors, planned to avoid spurious correlation. The net correlations of suicide with mean per cent. of sunshine, altitude, mean temperature, industrialization, and number of negroes are not significant; those with precipitation, age, density, and general mortality are low but possibly significant, high suicide rates being associated with low precipitation, density and general mortality, and high mean age. The correlation of suicide with proportion of males is $+ .41 \pm .04$.

General mortality is not significantly correlated with the climatic factors, age, proportion of males, or industrialization, but shows a low correlation ($+ .24 \pm .05$) with density and a high correlation ($+ .62 \pm .03$) with proportion of negroes. Proportion of negroes is positively correlated with precipitation and temperature but not with sunshine. Racial as well as economic factors are probably involved in this result.

The fundamental factors underlying differences in suicide rates are probably (1) difference in strength of the group spirit, (2) adverse economic changes, (3) racial factors, (4) health of population.

III. Bibliography.

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APPENDIX.

Values for each city of variables on which the correlations are based.

City.	1.	2*a*.	2*b*.	2*c*.	2*d*.	3. (0,000 omitted.)	4.	5. (0,000 omitted.)	6.	7.	8. (000 omitted.)	9. (000 omitted.)
Alabama:												
Birmingham	55	58	6	52	64	13	−114	7	32	6,302	20	52
Mobile	20	63	0	63	69	5	− 57	2	9	3,461	6	22
Montgomery	10	58	1	52	66	4	− 48	2	4	2,783	4	19
California:												
Berkeley	18	62	0	27	55	4	− 16	2	5	1,141	4	0
Los Angeles	305	72	3	16	62	32	− 14	16	233	13,248	46	7
Oakland	147	62	0	24	56	15	− 17	8	32	5,409	22	3
Pasadena	7	72	8	23	61	3	0	1	10	1,251	3	0
Sacramento	53	71	0	18	59	4	− 26	3	9	2,218	8	0
San Diego	46	66	0	11	60	4	0	2	50	2,061	5	0
San Francisco	571	62	0	23	55	42	− 34	24	27	18,394	71	1
San Jose	21	73	1	19	57	3	− 4	1	5	1,239	4	0
Colorado:												
Colorado Springs	12	69	60	15	48	3	− 18	1	6	1,455	5	1
Denver	223	69	52	15	51	21	− 28	11	37	10,277	31	5
Pueblo	26	76	46	11	52	4	− 61	2	7	1,697	6	1
Connecticut:												
Bridgeport	82	57	0	41	51	10	− 59	5	9	4,381	31	1
Hartford	72	48	0	39	50	10	− 36	5	10	5,111	20	1
New Britain	16	48	1	39	50	4	−105	2	8	1,792	14	0
New Haven	73	57	0	43	51	13	− 34	7	11	6,644	28	3

Values for each city of variables on which the correlations are based. (Continued.)

City.	1.	2*a*.	2*b*.	2*c*.	2*d*.	3. (0,000 omitted.)	4.	5. (0,000 omitted.)	6.	7.	8. (000 omitted.)	9. (000 omitted.)
Connecticut: (*Cont.*)												
Stamford	16	57	0	41	51	3	− 33	1	4	1,471	6	0
Waterbury	41	48	2	45	50	7	− 93	4	18	3,289	21	0
Delaware:												
Wilmington	30	57	0	43	55	9	− 32	4	4	4,329	20	9
District Columbia:												
Washington	263	56	0	38	56	33	− 21	16	38	18,768	39	94
Florida:												
Jacksonville	30	66	0	39	69	6	−101	3	6	3,707	8	29
Georgia:												
Atlanta	69	59	10	41	62	15	− 83	7	17	8,382	22	51
Savannah	27	65	0	40	67	7	− 84	3	4	5,089	8	33
Illinois:												
Aurora	13	57	6	34	49	3	− 20	2	4	1,255	7	0
Chicago	1,391	57	5	35	51	219	− 69	113	23	95,677	422	44
Decatur	19	62	6	40	52	3	− 20	2	5	1,120	5	0
Quincy	22	62	4	37	54	4	− 8	2	4	1,740	7	1
Springfield	53	62	6	37	53	5	− 26	3	6	2,535	7	2
Indiana:												
Evansville	42	56	3	41	57	7	− 31	3	6	2,898	14	6
Fort Wayne	39	57	7	35	51	6	− 33	3	7	2,341	13	0
Indianapolis	200	57	7	39	53	23	− 24	12	25	10,441	47	21

Values for each city of variables on which the correlations are based. (Continued.)

City.	1.	2*a*.	2*b*.	2*c*.	2*d*.	3. (0,000 omitted.)	4.	5. (0,000 omitted.)	6.	7.	8. (000 omitted.)	9. (000 omitted.)
Indiana: (*Cont.*)												
South Bend	32	57	7	38	49	5	− 66	3	10	2,196	14	0
Terre Haute	74	57	4	43	55	6	− 33	3	5	2,648	10	2
Kansas:												
Kansas City	44	63	7	37	56	8	− 57	4	10	3,935	16	9
Wichita	24	63	13	28	57	5	− 32	3	13	1,942	8	2
Kentucky:												
Covington	23	56	5	39	55	5	− 32	3	4	2,359	11	2
Louisville	120	56	4	47	57	22	− 32	11	14	10,753	43	40
Newport	23	56	5	39	55	3	− 33	1	1	1,251	8	0
Louisiana:												
New Orleans	174	62	0	63	70	34	− 54	16	125	20,901	45	89
Maine:												
Portland	16	57	0	36	46	6	− 7	3	14	3,181	8	0
Maryland:												
Baltimore	284	61	1	39	56	56	− 32	27	52	31,263	106	84
Massachusetts:												
Boston	354	59	0	35	51	67	− 31	33	28	34,029	113	13
Brockton	23	59	1	35	51	6	− 29	3	14	1,956	18	0
Brookline	5	59	0	35	51	3	− 6	1	4	963	2	0
Cambridge	24	59	0	35	51	10	− 30	5	4	4,692	20	4
Chelsea	14	59	0	35	51	3	− 43	2	1	1,736	7	0

Values for each city of variables on which the correlations are based. (Continued.)

City.	1.	2*a*.	2*b*.	2*c*.	2*d*.	3. (0,000 omitted.)	4.	5. (0,000 omitted.)	6.	7.	8. (000 omitted.)	9. (000 omitted.)
Massachusetts: (*Cont.*)												
Everett	6	59	0	35	51	3	− 31	2	2	1,134	6	0
Fall River	51	53	2	37	50	12	− 74	6	22	6,519	40	0
Fitchburg	19	59	4	36	48	4	− 46	2	18	1,438	11	0
Haverhill	21	59	0	33	48	4	− 11	2	21	2,029	14	0
Holyoke	18	48	0	39	50	6	− 82	3	13	2,906	19	0
Lawrence	30	59	0	33	48	9	− 69	4	4	4,336	31	0
Lowell	58	59	0	37	50	11	− 35	5	8	5,851	37	0
Lynn	23	59	0	35	51	9	− 23	4	7	3,506	29	0
Malden	12	59	0	35	51	4	− 24	2	3	1,648	8	0
New Bedford	33	53	0	37	50	10	− 55	5	12	5,117	32	2
Newton	12	59	0	35	51	4	− 12	2	11	1,379	5	0
Pittsfield	6	48	10	35	46	3	− 30	2	26	1,568	8	0
Quincy	11	59	0	35	51	3	− 42	2	11	1,151	7	0
Salem	13	59	0	35	51	4	− 27	2	5	2,111	11	0
Somerville	13	59	0	35	51	8	− 16	4	3	3,045	11	0
Springfield	48	48	0	39	50	9	− 26	4	20	4,170	18	1
Waltham	6	59	0	35	51	3	− 16	1	8	1,164	7	0
Worcester	41	59	4	36	49	15	− 32	7	24	7,012	36	1
Michigan:												
Battle Creek	15	49	8	36	48	3	− 14	1	4	1,169	6	0
Bay City	18	49	5	43	47	5	− 46	2	6	1,677	8	0

Values for each city of variables on which the correlations are based. (Continued.)

City.	1.	2*a*.	2*b*.	2*c*.	2*d*.	3. (0,000 omitted.)	4.	5. (0,000 omitted.)	6.	7.	8. (000 omitted.)	9. (000 omitted.)
Michigan: (*Cont.*)												
Detroit	291	49	6	31	49	47	− 64	24	50	20,580	116	5
Flint	10	49	7	28	47	4	− 78	2	18	1,337	13	0
Grand Rapids	56	49	6	36	49	11	− 28	6	11	4,483	23	0
Jackson	10	49	9	32	49	3	− 10	2	6	1,248	7	0
Lansing	13	49	8	30	47	3	− 37	2	7	1,052	8	0
Saginaw	20	49	6	32	49	5	− 21	2	9	2,171	9	0
Minnesota:												
Duluth	40	41	6	27	39	8	− 93	4	38	2,962	15	0
Minneapolis	180	61	8	27	45	30	− 55	16	32	10,278	53	2
St. Paul	91	61	7	27	45	21	− 69	11	33	7,266	35	3
Missouri:												
Kansas City	225	63	7	37	56	25	− 41	13	37	11,191	36	23
St. Louis	664	55	4	40	56	69	− 45	35	39	32,392	133	43
Nebraska:												
Lincoln	20	57	11	30	52	4	− 35	2	7	1,605	5	0
Omaha	117	57	10	23	52	12	− 48	6	24	5,371	17	4
New Hampshire:												
Manchester	19	57	1	35	48	7	− 48	3	21	3,808	25	0
New Jersey:												
Atlantic City	42	61	0	39	53	5	− 46	2	7	2,237	5	9
Bayonne	23	60	0	41	52	6	−170	3	3	2,298	13	0

Values for each city of variables on which the correlations are based. (Continued.)

City.	1.	2a.	2b.	2c.	2d.	3. (0,000 omitted.)	4.	5. (0,000 omitted.)	6.	7.	8. (000 omitted.)	9. (000 omitted.)
New Jersey: (*Cont.*)												
Camden	45	57	0	43	55	9	− 36	5	5	4,695	22	6
East Orange	11	60	1	47	53	3	− 16	2	3	1,006	4	1
Elizabeth	45	60	0	40	53	7	− 80	4	6	3,420	17	1
Hoboken	75	60	0	43	54	7	− 71	4	1	3,756	11	0
Jersey City	158	60	0	43	54	27	− 77	14	8	13,030	43	5
Newark	211	60	0	47	53	35	− 63	17	15	16,539	79	9
Orange	13	60	1	47	53	3	− 54	1	1	1,519	6	2
Passaic	17	60	0	43	52	5	−225	3	2	2,424	17	0
Paterson	76	60	1	43	52	13	− 49	6	5	5,553	37	1
Perth Amboy	10	60	0	40	53	3	−181	2	3	1,397	8	0
West Hoboken	15	60	2	43	54	4	− 78	2	1	1,198	8	0
New York:												
Albany	54	48	0	30	49	10	− 11	5	12	5,710	17	1
Amsterdam	10	48	2	35	46	3	− 55	2	3	1,389	12	0
Auburn	27	50	7	33	47	3	− 12	2	5	1,652	10	0
Buffalo	163	48	6	39	48	42	− 49	21	25	19,402	82	1
Elmira	36	38	8	27	49	4	− 11	2	5	1,637	7	0
Jamestown	19	50	13	36	49	3	− 18	2	5	1,141	9	0
Mt. Vernon	11	60	1	39	53	3	− 33	1	3	1,230	4	0
New Rochelle	9	60	0	39	53	3	− 74	1	6	991	4	1

Values for each city of variables on which the correlations are based. (Continued.)

City.	1.	2*a*.	2*b*.	2*c*.	2*d*.	3. (0,000 omitted.)	4.	5. (0,000 omitted.)	6.	7.	8.. (000 omitted.)	9. (000 omitted.)
New York City:												
Bronx	214	60	0	39	53	43	− 80	22	27	19,456	71	4
Brooklyn	765	60	0	39	53	163	− 69	81	45	74,512	292	22
Manhattan	1,357	60	0	39	53	233	− 80	117	13	113,609	444	60
Queens	145	60	0	39	53	28	− 78	14	67	11,848	53	3
Richmond	42	60	0	39	53	9	− 41	4	31	4,431	13	1
Niagara Falls	30	48	5	39	48	3	− 76	2	6	1,572	8	0
Poughkeepsie	13	48	0	46	49	3	− 5	1	2	1,530	6	0
Rochester	135	50	5	33	48	22	− 27	11	19	9,415	53	0
Schenectady	34	48	2	30	49	7	− 73	4	5	2,835	19	0
Syracuse	79	50	4	30	47	14	− 22	7	12	6,018	30	1
Troy	22	48	0	30	49	8	− 12	4	7	4,679	20	0
Watertown	17	46	4	36	45	3	− 11	1	5	1,326	6	0
Yonkers	24	60	0	39	53	8	− 93	4	13	3,523	18	1
North Carolina:												
Wilmington	6	66	0	37	63	3	− 73	1	4	1,849	3	12
Ohio:												
Akron	41	48	9	36	50	7	− 56	4	15	2,497	20	0
Canton	21	48	10	39	51	5	− 40	3	8	1,654	13	0
Cincinnati	204	56	5	39	55	36	− 23	18	46	18,278	76	19
Cleveland	342	48	6	35	50	56	− 75	29	36	22,679	128	8
Columbus	129	55	7	38	53	18	− 29	9	14	7,717	34	12

Values for each city of variables on which the correlations are based. (Continued.)

City.	1.	2*a*.	2*b*.	2*c*.	2*d*.	3. (0,000 omitted.)	4.	5. (0,000 omitted.)	6.	7.	8. (000 omitted.)	9. (000 omitted.)
Ohio: (*Cont.*)												
Dayton	88	56	7	40	53	12	− 24	6	10	4,809	29	4
Hamilton	25	56	6	39	55	4	− 32	2	3	1,404	9	0
Lima	18	55	8	41	51	3	− 41	2	4	1,152	6	0
Lorain	13	48	6	35	50	3	−152	2	6	1,118	8	0
Newark	13	55	8	38	53	3	− 21	1	3	900	5	0
Springfield	11	55	9	46	53	5	− 15	2	7	1,794	11	4
Toledo	122	53	6	36	50	17	− 33	4	18	7,340	32	1
Youngstown	36	47	8	41	50	8	−108	8	16	3,652	20	1
Zanesville	11	55	7	38	53	3	− 12	1	4	1,266	6	1
Oregon:												
Portland	167	42	0	39	52	21	− 38	12	40	6,409	40	1
Pennsylvania:												
Allentown	17	57	2	42	51	5	− 35	3	4	2,434	13	0
Altoona	18	52	11	32	51	5	− 55	3	2	1,866	9	0
Chester	10	57	0	43	55	4	− 40	2	3	1,845	11	4
Easton	29	57	3	42	51	3	− 11	1	2	1,354	6	0
Erie	34	50	7	36	49	7	− 40	3	5	3,065	15	0
Harrisburg	36	52	3	33	53	6	− 24	3	4	2,788	11	4
Johnstown	12	47	11	45	52	6	−119	3	3	2,598	14	0
Lancaster	22	52	3	33	53	5	− 11	2	3	2,039	12	0
McKeesport	36	47	7	35	53	4	−130	2	2	2,160	10	0

Values for each city of variables on which the correlations are based. (Continued.)

City.	1.	2*a*.	2*b*.	2*c*.	2*d*.	3. (0,000 omitted.)	4.	5. (0,000 omitted.)	6.	7.	8. (000 omitted.)	9. (000 omitted.)
Pennsylvania: (*Cont.*)												
New Castle	16	47	8	40	50	4	− 71	2	6	1,610	8	0
Philadelphia	832	57	0	43	55	155	− 34	76	85	77,518	340	84
Pittsburgh	329	47	7	35	53	53	− 72	27	25	25,716	105	25
Reading	67	57	2	41	53	10	− 30	5	6	4,126	27	0
Scranton	39	52	7	37	50	13	− 99	7	12	6,156	18	0
Wilkes-Barre	15	52	5	35	51	7	− 91	3	3	3,196	10	0
Williamsport	11	52	5	35	51	3	− 13	1	5	1,499	6	0
York	19	52	3	33	53	4	− 24	2	2	1,960	12	1
Rhode Island:												
Newport	3	53	0	43	49	3	− 43	1	4	1,131	3	1
Pawtucket	17	53	0	35	50	5	− 36	3	5	2,396	16	0
Providence	109	53	0	35	50	22	− 30	11	11	11,005	56	5
Woonsocket	12	53	1	35	50	4	− 91	2	6	1,679	13	0
South Carolina:												
Charleston	12	70	0	37	66	6	− 65	3	3	5,014	8	31
Tennessee:												
Knoxville	19	59	9	48	59	4	− 80	2	23	1,926	5	7
Memphis	94	65	2	42	62	13	− 72	7	12	7,908	17	52
Nashville	48	59	4	46	60	11	− 48	5	12	6,287	16	36
Texas:												
San Antonio	65	55	6	17	70	10	− 74	5	23	6,123	11	10

Values for each city of variables on which the correlations are based. (Continued.)

City.	1.	2*a*.	2*b*.	2*c*.	2*d*.	3. (0,000 omitted)	4.	5. (0,000 omitted.)	6.	7.	8. (000 omitted.)	9. (000 omitted.)
Utah:												
Ogden	19	61	43	20	50	3	− 87	1	11	883	3	0
Salt Lake City	76	61	43	15	52	9	− 72	5	33	3,595	12	0
Virginia:												
Lynchburg	7	58	6	37	57	3	− 83	1	3	1,448	5	9
Norfolk	40	61	0	38	60	7	− 72	3	5	4,620	10	25
Richmond	46	60	0	38	58	13	− 57	6	15	7,964	25	46
Washington:												
Seattle	242	39	0	29	50	24	− 60	14	37	6,623	40	2
Spokane	74	53	19	15	48	10	− 58	6	25	3,849	16	0
Tacoma	71	40	0	39	50	8	− 48	5	25	2,599	15	0
West Virginia:												
Wheeling	29	47	6	37	53	4	− 36	2	1	2,126	9	1
Wisconsin:												
Green Bay	12	57	6	29	45	3	− 72	1	8	1,439	4	0
La Crosse	17	54	6	30	46	3	− 31	1	6	1,200	5	0
Madison	16	52	8	29	47	3	− 30	1	4	886	4	0
Milwaukee	232	56	6	26	47	37	− 62	19	16	14,638	87	0
Oshkosh	14	57	7	28	45	3	− 25	2	5	1,218	7	0
Racine	21	56	6	27	48	4	− 46	2	4	1,370	11	0
Superior	27	41	6	26	39	4	−120	2	23	1,314	7	0

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